

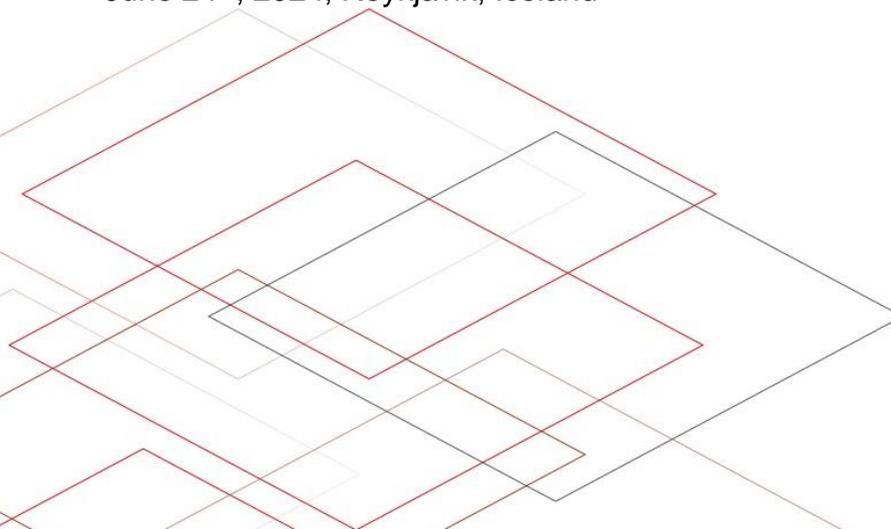
ORKG: Describing Papers Manually and Creating an ORKG Comparison

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ORKG Comparisons

Acknowledgement of creators

DOI

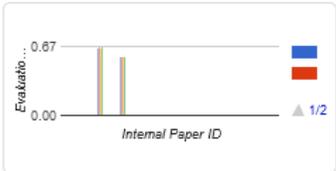
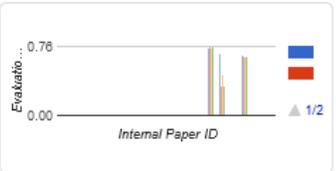
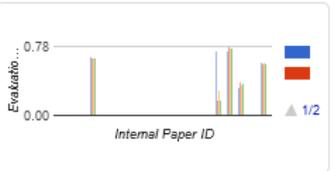
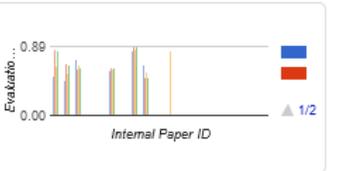
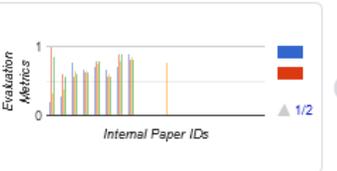
Visualizations

Interactive filtering

Overview of Approaches that Classify User Feedback as Feature Request ☆ 👁

📅 June 2021 👤 Oliver Karras 👤 Eduard C. Groen

This overview shows the classification results of approaches that use the machine learning algorithms Naïve Bayes, Support Vector Machines, and Decision Trees C4.5 in combination with the machine learning features Bag of Words or Term Frequency - Inverse Document Frequency to classify user feedback as feature request.

Properties	Software Feature Request Detection in Issue Tracking Systems <i>User Feedback Classification - 2016</i>	Mining User Requirements from Application Store Reviews Using Frame Semantics <i>User Feedback Classification - 2017</i>	Mining Twitter Feeds for Software User Requirements <i>User Feedback Classification - 2017</i>	Automatic Classification of Non-Functional Requirements from Augmented App User Reviews <i>User Feedback Classification - 2017</i>	Bug reports simply classified <i>User Feedback Classification - 2017</i>
has dataset	https://zenodo.org/record/56907#.YKT_NudCRPY	https://mast.informatik.uni-hamburg.de/wp-content/uploads/2014/03/REJ_data.zip https://sites.google.com/site/appsuserreviews/ seel.cse.lsu.edu/data/refsq17.zip	seel.cse.lsu.edu/data/re17.zip	Not available	https://mast.informatik.uni-hamburg.de/wp-content/uploads/2014/03/REJ_data.zip

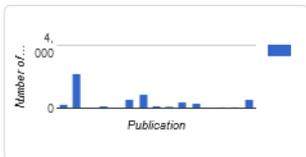
Example: ORKG Comparison of Related Work – State of the Art^[5]

A Comparison of Scientific Publications on the State of Empirical Research in Requirements Engineering and Software Engineering

November 2023 Oliver Karras Felix Wernlein Jil Ann-Christin Klünder Sören Auer

This comparison provides an overview of scientific publications that have investigated primary studies in requirements engineering and software engineering to give a snapshot of the "current" state of empirical research in requirements engineering and software engineering. In particular, the comparison shows for each publication (1) which research fields and topics were investigated, (2) whether and where the extracted and analyzed data is available, and (3) which method was used to determine the state, including further details about the respective method.

DOI: <https://doi.org/10.48366/R650023>



Properties	Status of Empirical Research in Software Engineering Empirical research - 2007	The type of evidence produced by empirical software engineers Empirical research - 2005	Research in software engineering: an analysis of the literature Empirical research - 2002
method	Literature review	Literature review	Literature review
data availability	✗	✗	✗
time interval/era covered			
"last harvested"	1996-01-01	1997-01-01	1999-01-01
"last used"	2006-09-30	2003-12-31	1999-12-31
number of papers	113	119	360

Figure 1: Comparison of related publications on the "current" state and evolution of empirical research in RE and SE [16].

Figure 1 shows an excerpt from a comparison that we created to get an overview of related publications on the "current" state and evolution of empirical research in RE and SE [16]. For three publications, the excerpt shows the method used, the data availability, as well as the period and the number of papers examined. We use the ORKG due to its cross-domain and cross-topic characteristics, as well as its successful application for CrowdRE by Karras et al. [42].

III. RELATED WORK

Below, we review 14 publications that provide snapshots of the "current" state and evolution of empirical research in RE and SE (see Table I) [16]. We only consider publications that address the topic in general and are not limited to specific aspects, such as a method [67], [68] or a context [69], [70].

We found five publications on empirical research in RE published between 2005 and 2016 and nine on empirical research in SE published between 2002 and 2021. While one publication [1] examined empirical research in RE using a survey with 42 respondents, the other 13 publications [2], [3], [5]–[15] used (systematic) literature reviews or systematic mapping studies to analyze on average 402.9 papers (minimum: 20, median: 154, and maximum: 2237 papers) published between 1977 and 2019 with overlapping periods. In total, these 13 publications examined papers from a total of 60 different venues on 18 different themes. Nine of the 60 venues and ten of the 18 themes were examined by more than two publications. These facts show that there is considerable overlap and redundancy between these publications in terms of

goals, methods used, periods, venues, and themes examined. This overlap and redundancy could have been avoided if researchers had collaborated to build on and update earlier works. However, only four out of 14 publications offer their data at all, with only one publication [15] using a public data repository [71], [72]. The other three publications only offer links that no longer work [5], [12], [13].

In terms of key findings, the 14 publications show consistent results, although not all 18 themes were examined in all publications. For example, eleven of the 14 publications reported on the most commonly used research methods. Until 2000, the most common research methods were conceptual analysis and concept implementation [7]. Between 2000 and 2015, the most commonly used research methods changed to case studies and experiments [3], [5], [8]–[11], which were expanded after 2015 to also include surveys and systematic literature reviews [12]–[15]. While this change shows an evolution of research methods used, we also note that experiments and case studies have been the two main research methods for empirical research in RE and SE for more than 20 years. Although these two research methods have been used for a long time, seven publications concluded that there is a need to develop, expand, and use standardized terminology and theories (from other disciplines) to more consistently represent the empirical research conducted and better explain the results found [1], [2], [6]–[8], [12], [13]. In this regard, seven publications also analyzed the information reported for a comprehensive description of a research design. This information includes details about the research question(s) [1], contextual factors [6],

Table I: Details of related publications on the "current" state and evolution of empirical research in RE and SE [16]. Legend: Literature Review (LR), Systematic Literature Review (SLR), and Systematic Mapping Study (SMS)

Paper	Year	Field	Method	Period	Data basis	Dataset	Venues (Frequency > 2)	Themes (Frequency > 2)
[6]	2005	RE	LR	1968 – 2002	35 papers	Unavailable		
[15]	2016	RE	SLR	1977 – 2015	154 papers	Available		
[11]	2012	RE	Survey	1970.03.2012 – 2012	42 respondents	Unavailable	1) Empirical Software Engineering Journal (8)	1) Data collection (12)
[2]	2014	RE	LR	2003.2014	2237 papers	Unavailable	2) IEEE Software (4)	2) Research method (11)
[3]	2016	RE	SMS	Open – 2012	290 papers	Unavailable	3) Requirements Engineering Journal (4)	3) Bibliographic metadata (10)
[8]	2002	SE	LR	1997 – 1998	707 papers	Unavailable	4) ACM/IEEE International Symposium on Empirical Software Engineering and Measurement (4)	4) Data analysis (8)
[12]	2002	SE	LR	1996 – 2002	68 papers	Unavailable	5) IEEE Transactions on Software Engineering (3)	5) Research paradigms (7)
[1]	2005	RE	LR	1997 – 2005	119 papers	Unavailable	6) International and Software Technology Journal (3)	6) Research design (7)
[10]	2006	RE	LR	1997 – 2005	65 papers	Unavailable	7) IEEE International Requirements Engineering Conference (3)	7) Research topic (5)
[11]	2007	SE	LR	1996 – 2003	133 papers	Unavailable	8) Journal of Systems and Software (3)	8) Research context (4)
[14]	2015	RE	SMS	1996 – 2011	392 papers	Broken link	9) International Conference on Software Engineering (3)	9) Sample of population (4)
[13]	2018	RE	SMS	2017 – 2017	336 papers	Broken link		10) Theory (5)
[14]	2019	RE	SMS	2001 – 2014	343 papers	Unavailable		
[13]	2021	RE	SMS	Open – 2019	20 papers	Available		

Properties	Empirical research in requirements engineering: trends and opportunities <i>Empirical research - 2016</i>	Empirical research methodologies and studies in Requirements Engineering: How far did we come? <i>Empirical research - 2014</i>	A Survey on Empirical Requirements Engineering Research Practices <i>Empirical research - 2012</i>	Evidence-Based Structuring and Evaluation of Empirical Research in Requirements Engineering: Fundamentals, Framework, Research Map <i>Empirical research - 2010</i>	An Analy... Data <i>Empirical...</i>
research problem	empirical research in requirements engineering	empirical research in requirements engineering	empirical research in requirements engineering	empirical research in requirements engineering	empirical research in requirements engineering
research field investigated	Requirements Engineering	Requirements Engineering	Requirements Engineering	Requirements Engineering	Requirements Engineering
topic investigated	bibliographic metadata context data collection	bibliographic metadata research topic theory	context	context	

<https://doi.org/10.48366/R650023>

[5] Karras et al.: *Divide and Conquer the EmpiRE: A Community-Maintainable Knowledge Graph of Empirical Research in Requirements Engineering*. 2023 ACM/IEEE International Symposium on Empirical Software Engineering and Measurement (ESEM), DOI: [10.1109/ESEM56168.2023.10304795](https://doi.org/10.1109/ESEM56168.2023.10304795), 2023.

Example: ORKG Comparison of Literature – ML Approaches^[9]

Overview of Approaches that Classify User Feedback as Feature Request ☆ 👁

June 2021 Oliver Karras Eduard C. Groen

This overview shows the classification results of approaches that use the machine learning algorithms Naïve Bayes, Support Vector Machines, and Decision Trees C4.5 in combination with the machine learning features Bag of Words or Term Frequency - Inverse Document Frequency to classify user feedback as feature request.

DOI: <https://doi.org/10.48366/r112387>

Properties	Software Feature Request Detection in Issue Tracking Systems <i>User Feedback Classification - 2016</i>	Mining User Requirements from Application Store Reviews Using Frame Semantics <i>User Feedback Classification - 2017</i>	Mining Twitter Feeds for Software User Requirements <i>User Feedback Classification - 2017</i>	Automatic Classification of Non-Functional Requirements from Augmented App User Reviews <i>User Feedback Classification - 2017</i>	Bug reports simply classified <i>User Feedback Classification - 2017</i>
has dataset	https://zenodo.org/record/56907#.YKT_NudCRPY	https://mast.informatik.uni-hamburg.de/wp-content/uploads/2014/03/REJ_data.zip https://sites.google.com/site/appsuserreviews/ seel.cse.lsu.edu/data/refsq17.zip	seel.cse.lsu.edu/data/re17.zip	Not available	https://zenodo.org/record/56907#.YKT_NudCRPY
https://doi.org/10.48366/r112387					

Fig. 2: Excerpt from our comparison for Case II [35].

77 papers from the SLR by Khan et al. [18], describing the relation of the papers to five phases of RE and the CrowdRE utilities applied [36]. We are still in the process of adding the contributions from the remaining 50 papers, which is more time-consuming than for the quantitative data from Case I because of the expert judgments needed for classifying the papers' contributions. The comparison of the 27 papers makes it easy to identify, for example, the four papers that address the runtime purpose of monitoring for requirements evolution.

With the created comparisons [35], [36], we achieved our goal of acquiring and curating the detailed results of both SLRs. The knowledge-based representation in the form of comparisons has several advantages over a purely document-based representation. The comparisons are interactive and allow filtering of views by different scholarly knowledge contained in each row, even by specific value ranges of qualitative and quantitative content. The ORKG also provides a service for generating several graphical visualizations based on data in the comparisons, helping the reader understand information faster than through the large comparison table. The most important feature of the ORKG is that the added contributions and created comparisons are available to anyone. In this way, every crowd member can use the curated scholarly knowledge and created comparisons as a basis for new comparisons. Moreover, the existing comparisons can be expanded with additional scholarly knowledge from papers already included, and even with new contributions from papers added later to the ORKG. We already expanded several contributions, e.g., the results of other classifications reported in Dhinakaran et al.'s paper [40]¹⁹. For Case I, we added the details of the three crowd properties *scale, level of knowledge, skills & expertise, and roles*, which are only briefly and superficially described in the SLR [18]. For Case II, we added links to the datasets used and performance values to classification categories other than "Feature Request". This expansion is relevant to enable long-term curation. For

example, a development succeeding the SLR by Santos et al. [17] are reports of Deep Learning algorithms showing promising results in classifying user feedback [41], [42], which should be successively added to the comparison.

Despite all these advantages, the ORKG also has limitations. Most of the limitations we experienced can be attributed to the development status of the platform, which is currently in beta. Further development of the ORKG must improve interactions for the expert crowd by enabling better workflows for entering data and creating visualizations. Nevertheless, we also experienced that the project team has always responded directly to our reported issues, which we could see getting added to the GitLab issue tracker¹¹ and addressed shortly thereafter.

V. DISCUSSION

The ORKG aroused our interest as a crowdsourcing platform for applying and communicating CrowdRE research. In this experience report, we explored whether the ORKG can promote the potential of CrowdRE in open source and open research settings, taking two perspectives: that of CrowdRE researchers and that of crowd members.

Our first contribution is that we provide a comprehensive overview of the ORKG's features as a crowdsourcing platform for acquiring and curating scholarly knowledge [37], mapped to the four key activities of CrowdRE. Our findings show that the ORKG is a crowdsourcing platform offering several features that can facilitate successful CrowdRE. Although the ORKG project team has not yet consciously applied CrowdRE, they already address crucial parts of the CrowdRE cycle by motivating crowd members to participate, eliciting feedback, and monitoring context & usage data, which they analyze to derive and implement the needs and requirements of the crowd.

To motivate crowd members, the project team uses established mechanisms and incentives to boost intrinsic and extrinsic motivation (see Finding 1). Feedback is elicited

¹⁹<https://www.orkg.org/orkg/paper/R76818/R76825>

¹¹<https://gitlab.com/TIBHannover/orkg/orkg-frontend/-/issues/634>

[9] Karras et al.: *Researcher or Crowd Member? Why not both! The Open Research Knowledge Graph for Applying and Communicating CrowdRE Research*. 2021 IEEE 29th International Requirements Engineering Conference Workshops (REW), DOI: [10.1109/REW53955.2021.00056](https://doi.org/10.1109/REW53955.2021.00056), 2021.

Example: ORKG Comparison of Literature – Simulation Parameters^[10]

Comparison of Studies on Germany's Energy Supply in 2050 ★ 🔍

📅 November 2021
👤 Felix Kullmann
👤 Jan Göpfert
👤 Oliver Karras
👤 Patrick Kuckertz
👤 Sören Auer
👤 Markus Stocker
👤 Peter Markewitz

👤 Leander Kotzur
👤 Detlef Stolten

This comparison compiles the results from various studies analyzing a future low-carbon energy system for Germany. The focus of this study comparison is electricity generation. In the future, however, other essential characteristics of the respective energy system designs in the individual studies will be listed. Installed capacity is given in GW and electricity generation is given in TWh. The authors would like to thank the German Federal Government, the German State Governments, and the Joint Science Conference (GWK) for their funding and support as part of the NFDI4ing consortium. Funded by the German Research Foundation (DFG) - project number: 442146713. This work was also supported by the Helmholtz Association under the program "Energy System Design".

DOI: <https://doi.org/10.48366/r153801>

Properties	Klimaneutrales Deutschland <i>Contribution - 2020</i>	Wasserstoff-Roadmap Nordrhein-Westfalen <i>Contribution - 2020</i>	Wege zu einem klimaneutralen Energiesystem <i>Contribution - 2020</i>	Wege für die Energiewende <i>Contribution - 2019</i>	Den Weg der Energiewende <i>Contribution - 2019</i>
has energy_sources	all sources	all sources	all sources	all sources	
	bioenergy	bioenergy	bioenergy	bioenergy	
	geothermics	geothermics	geothermics	geothermics	
	hydropower	hydropower	hydropower	hydropower	
	import	import			
	net import	net import			

<https://doi.org/10.48366/r153801>

O. Karras et al. | Organizing Scientific Knowledge From Energy System Research Using the ORKG

and GHG scenarios [14] (see Figure 1). In contrast to the traditional way of publishing an overview of scenarios within a publication, ORKG *comparisons* provide the benefit that they are versionable and can thus be continuously (re)used, updated, and expanded. When researchers publish new scenarios as factsheets or in publications, the ORKG *comparisons* can be easily extended by describing the new scenarios using the same ORKG *templates*, adding the new ORKG *contribution* to the respective ORKG *comparison*, and publishing the updated ORKG *comparison* as a new version. The ORKG also supports the supplementation of ORKG *comparisons* by creating visualizations based on the data contained therein either directly from the web frontend or via various access points, such as a REST API, a Python or R package, or a SPARQL endpoint, for example in combination with a Jupyter notebook.

Figure 1. ORKG comparison of 25 scenarios from GHG studies for Germany [14].

In addition, we established an ORKG *observatory* on Energy System Research¹². The ORKG *observatory* serves as a central access point to all related curated publications, comparisons, and visualizations so that other researchers can easily explore the content. For example, Auer et al. [15] already reused the curated scientific knowledge from our two ORKG *comparisons* by identifying and answering further natural language competency questions from domain experts beyond the previous consideration. For this purpose, they specified the competency question as SPARQL query (see Listing 1). We executed this query on the SPARQL endpoint and visualized the results in Figure 2. In particular, these results show that average energy supply from photovoltaics and onshore wind power increased approximately fourfold from the 2006 – 2010 interval to the 2016 – 2020 interval.

¹²https://orkg.org/observatory/Energy_System_Research

[10] Karras et al.: *Organizing Scientific Knowledge From Energy System Research Using the Open Research Knowledge Graph*. 1st NFDI4Energy Conference, DOI: [10.48550/arXiv.2401.13365](https://doi.org/10.48550/arXiv.2401.13365), 2024.

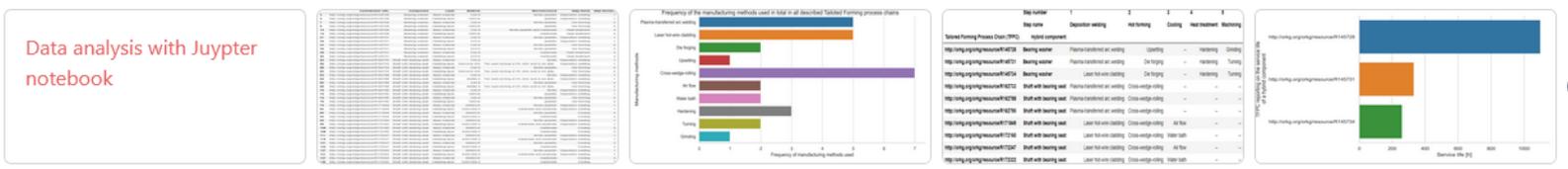
Example: ORKG Comparison of Literature – Process Variants^[11]

Tailored Forming Process Chain for the Manufacturing of Hybrid Components with Bearing Raceways Using Different Material Combinations ★

May 2022 Oliver Karras Laura Budde Paulina Merkel

This comparison provides an overview of Tailored Forming process chains carried out in the CRC 1153 "Tailored Forming" for the manufacturing of hybrid components with bearing raceways using different material combinations. A variety of materials combinations is used for the Tailored Forming of such hybrid components. The comparison shows the combined materials, the entire Tailored Forming process chain with its individual steps, and the resulting hybrid component with its qualities. For each step, the comparison shows the measurement methods performed and their results for the individual qualities of the hybrid components. In this way, the comparison shows how different qualities of the hybrid components change during the process due to the manufacturing methods used.

DOI: <https://doi.org/10.48366/r187049>



Properties	Investigation of the material combination 20MnCr5 and X45CrSi9-3 in the Tailored Forming of shafts with bearing seats	Investigation of the material combination 20MnCr5 and X45CrSi9-3 in the Tailored Forming of shafts with bearing seats	Investigation of the material combination 20MnCr5 and X45CrSi9-3 in the Tailored Forming of shafts with bearing seats	Investigation of the material combination 20MnCr5 and X45CrSi9-3 in the Tailored Forming of shafts with bearing seats	Cross-welded rolling material
has material/material					
belongs to material group*	Steel	Steel	Steel	Steel	
has type*	20MnCr5 X45CrSi9-3	20MnCr5 X45CrSi9-3	20MnCr5 X45CrSi9-3	20MnCr5 X45CrSi9-3	1 Claddi (100Cr6)

<https://doi.org/10.48366/r187049>

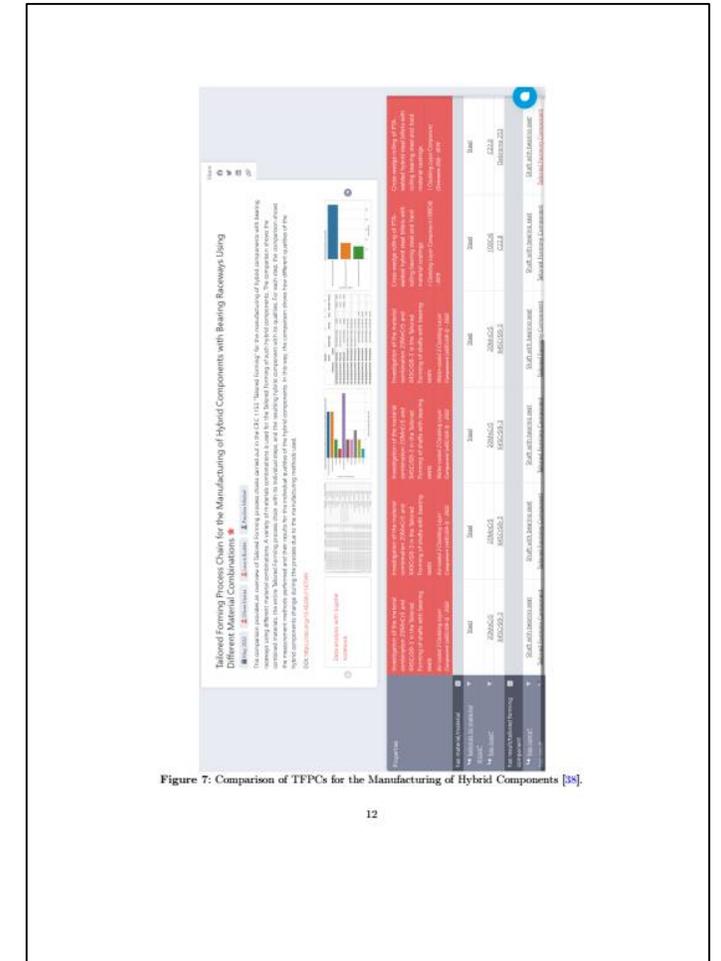


Figure 7: Comparison of TFPCs for the Manufacturing of Hybrid Components [8].

[11] Karras et al.: *Organizing Scientific Knowledge from Engineering Sciences Using the Open Research Knowledge Graph: The Tailored Forming Process Chain Use Case. Under Review* at Data Science Journal, 2024.

Example: ORKG Comparison of Literature – Software Features^[12]

Comparison of Hyperparameter Optimization Tools ★

January 2023 Oliver Karras Difan Deng Marius Lindauer

This comparison looks at the capabilities of various optimization tools for hyperparameter optimization, focusing on the following: Complex hyperparameter space, multi-objective, multi-fidelity, instances, command-line interface, and parallel computing. In addition, this comparison provides further information about the respective optimization tool, such as the locations of the code repository, README, software documentation and issue tracker, license and programming language.

DOI: <https://doi.org/10.48366/r281265>

Properties	BoTorch: A Framework for Efficient Monte-Carlo Bayesian Optimization <i>BoTorch - 2020</i>	OpenBox: A Generalized Black-box Optimization Service <i>OpenBox - 2021</i>	BOHB: Robust and Efficient Hyperparameter Optimization at Scale <i>HpBandSter - 2018</i>	SMAC3: A Versatile Bayesian Optimization Package for Hyperparameter Optimization <i>SMAC3 - 2021</i>
result/software				
name*	BoTorch	OpenBox	HpBandSter	SMAC3
software features*	Complex Hyperparameter Space	Complex Hyperparameter Space	Complex Hyperparameter Space	command-line interface
	Multi-Fidelity	Multi-Objective	Multi-Fidelity	Complex Hyperparameter Space
	Multi-Objective	Multi-Objective	Multi-Fidelity	Instances
	parallel computing	parallel computing	parallel computing	Multi-Fidelity
				Multi-Objective
				parallel computing
complex hyperparameter space*	✗	✓	✓	✓
multi-objective*	✓	✓	✗	✓
multi-fidelity*	✓	✗	✗	✗
instance*	✗	✗	✗	✗

<https://doi.org/10.48366/r281265>

Command-Line Interface

SMAC can not only be executed within a python file but also from the commandline. Consequently, not only algorithms in python can be optimized, but implementations in other languages as well.

Note

Command-line interface has been temporarily disabled in v2.0. Please fall back to v1.4 if you need it.

Comparison

The following table provides an overview of SMAC's capabilities in comparison with other optimization tools.

Package	Complex Hyperparameter Space	Multi-Objective	Multi-Fidelity	Instances	Command-Line Interface
HyperMapper	✓	✓	✗	✗	✗
Optuna	✓	✓	✓	✗	✓
Hyperopt	✓	✗	✗	✗	✓
BoTorch	✗	✓	✓	✗	✗
OpenBox	✓	✓	✗	✗	✗
HpBandSter	✓	✗	✓	✗	✗
SMAC	✓	✓	✓	✓	✓

Goal: ORKG Comparison on Reported Empirical Research

Comparison | 4 contributions

Overview of Reported Empirical Research in Requirements Engineering Publications from 2021

This comparison shows an overview of reported empirical research in publications of the IEEE International Requirements Engineering Conference from the year 2021

Properties	On the impact of using different templates on creating and understanding user stories Contribution 1 - 2021	Ambiguity and Generality in Natural Language Privacy Policies Contribution 1 - 2021	Environment-Driven Abstraction Identification for Requirements-Based Testing Contribution 1 - 2021	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation Contribution 1 - 2021
research question/research question				
↳ question*	Do different user story templates have an impact on the creation of user stories? Do different user story templates have an impact on the understanding of user stories?	To what extent does the classification model reduce the manual ontology construction effort? What is the effect of missing transitive hypernymy on classification performance?	No question.	How much is the difference in terms of documented requirements and roles with respect to initial ideas? What is the relevance given to the different categories of requirements and roles with respect to initial ideas? What is the relevance given to the different categories of requirements and roles with respect to initial ideas?
↳ highlighted in text*	✓ ✓	✓ ✓	✗	✓ ✓ ✓
↳ hidden in text*	✗ ✗	✗ ✗	✗	✗ ✗ ✗
data collection method/data collection method				
↳ method*	experiment	experiment	experiment	experiment
↳ number of participants*	41	0	0	30
data analysis method/data analysis method/method*	descriptive statistics inferential statistics	descriptive statistics machine learning	comparative analysis descriptive statistics machine learning	descriptive statistics inferential statistics thematic analysis
threats to validity/threats to validity				
↳ conclusion validity*	✓	✗	✗	✗
↳ construct validity*	✓	✓	✓	✓
↳ external validity*	✓			
↳ internal validity*	✓			

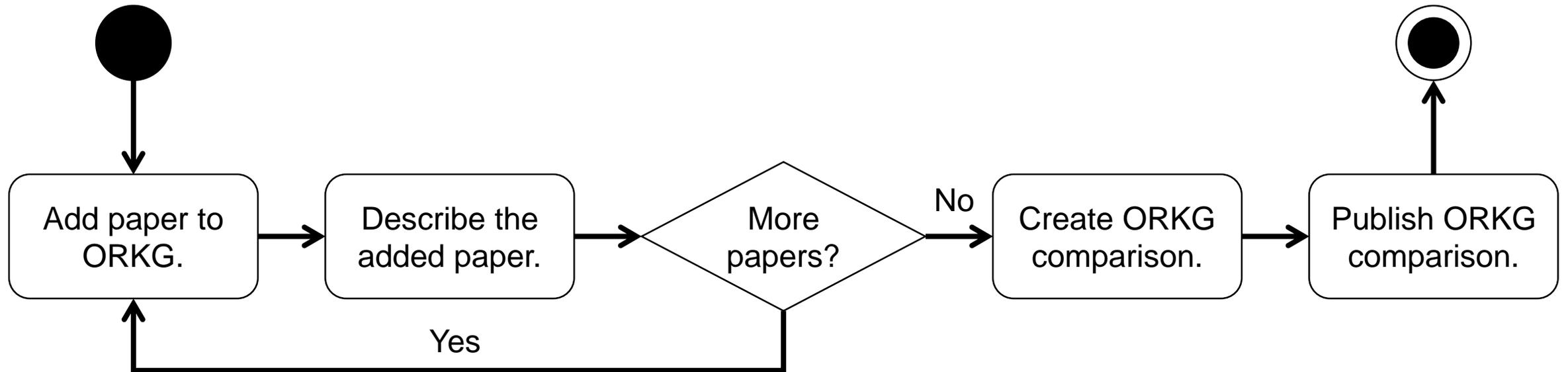
<https://sandbox.orkg.org/comparison/R369109>

Topic: Reported Empirical Research

- Empirical Research
 - *Research question*
 - Question
 - Hidden in text
 - Highlighted in text
 - *Data Collection Method*
 - Method
 - Number of participants
 - *Data Analysis Method*
 - Method
 - *Threats to Validity*
 - Construct Validity
 - Internal Validity
 - External Validity
 - Conclusion Validity

The screenshot displays the ORKG (Open Research Knowledge Graph) interface. At the top, there is a navigation bar with the ORKG logo, a search bar, and a '+ Add new' button. Below the navigation bar, the page title 'Paper' is visible, along with options for 'Access paper', 'Discussion (0)', and 'Edit'. The main content area shows the title of the paper: 'Environment-Driven Abstraction Identification for Requirements-Based Testing'. Below the title, there are tags for 'September 2021', '5 citations', 'Software Engineering', and several authors: 'Zedong Peng', 'Prachi Rathod', 'Nan Niu', 'Tanmay Bhowmik', 'Hui Liu', 'Lin Shi', and 'Zhi Jin'. The publication information is 'Published in: 2021 IEEE 29th International Requirements Engineering Conference (RE)' and the DOI is 'https://doi.org/10.1109/re51729.2021.00029'. The main content area is titled 'Contribution 1' and shows a table of applied templates. The table has two columns: the first column lists the template names, and the second column lists the corresponding values. The values are: 'comparative analysis', 'machine learning', 'descriptive statistics', 'experiment', 'No question.', and 'Construct validity: true, Internal validity: true, External validity: true Conclusion validity: false'. On the right side of the page, there is a sidebar with a 'Provenance' tab and a 'Timeline' tab. The 'Provenance' tab shows the paper was 'Added on 08 May 2024' and 'Added by Oliver Karras'. There is also a 'Contributors' section listing 'Oliver Karras' and an 'Assign to observatory' button.

Overall Process for Creating an ORKG Comparison



Remark:

Instead of going through the loop, we will work **collaboratively** in the tutorial as conceived by ORKG. We will take all papers from all participants and compare them with each other in an ORKG comparison.

An ORKG comparison requires **at least two** publications.

1. Open ORKG Website

The screenshot shows the ORKG website interface. At the top, there is a navigation bar with the ORKG logo, menu items (View, Tools, About), a dropdown menu for 'NFDI4DataScience', a search bar, and buttons for '+ Add new' and 'Sign in'. Below the navigation bar, the main heading reads 'Scholarly Knowledge. Structured.' followed by a sub-heading: 'The Open Research Knowledge Graph (ORKG) aims to describe research papers in a structured manner. With the ORKG, papers are easier to find and compare. Play video'. A section titled 'Browse by research field' contains five red buttons: 'Arts and Humanities' (443 papers - 34 comparisons), 'Engineering' (3434 papers - 356 comparisons), 'Life Sciences' (4169 papers - 206 comparisons), 'Physical Sciences & Mathematics' (15830 papers - 745 comparisons), and 'Social and Behavioral Sciences' (944 papers - 174 comparisons). Below this, there are tabs for 'Comparisons', 'Papers', 'Visualizations', 'Reviews', and 'Lists'. The 'Comparisons' tab is active, showing a search bar and a dropdown menu set to 'Top recent'. A snippet of a comparison is visible: 'Overview on studies about the role of (social) media in political polarization across the years 2011 to 2020'. On the right side, there is a 'Latest Mastodon posts' section with a post from 'Open Research Knowledge Graph' (@orkg@mastodon.social) with the text 'Wonder why #reborn papers come with a butterfly 🦋?'.

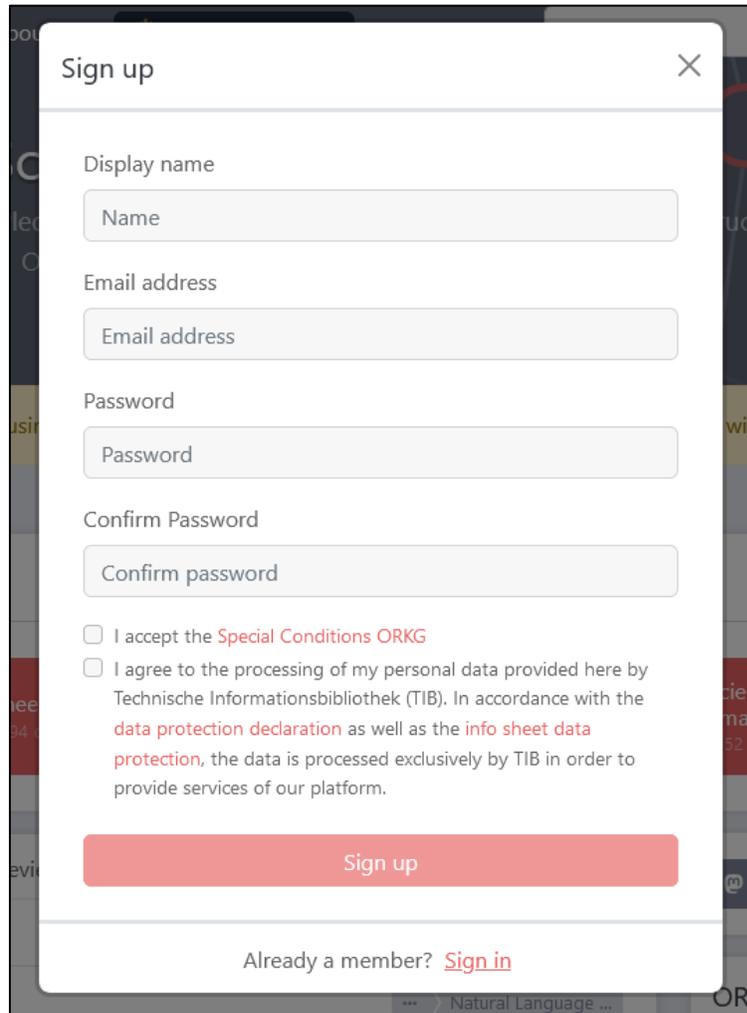
Remark:

For the tutorial, we use the **ORKG test environment** (<https://sandbox.orkg.org/>) to try everything without hesitation. You can find the official ORKG at <https://orkg.org/>.

Get your exemplary paper: <https://bit.ly/3UGFwhj>

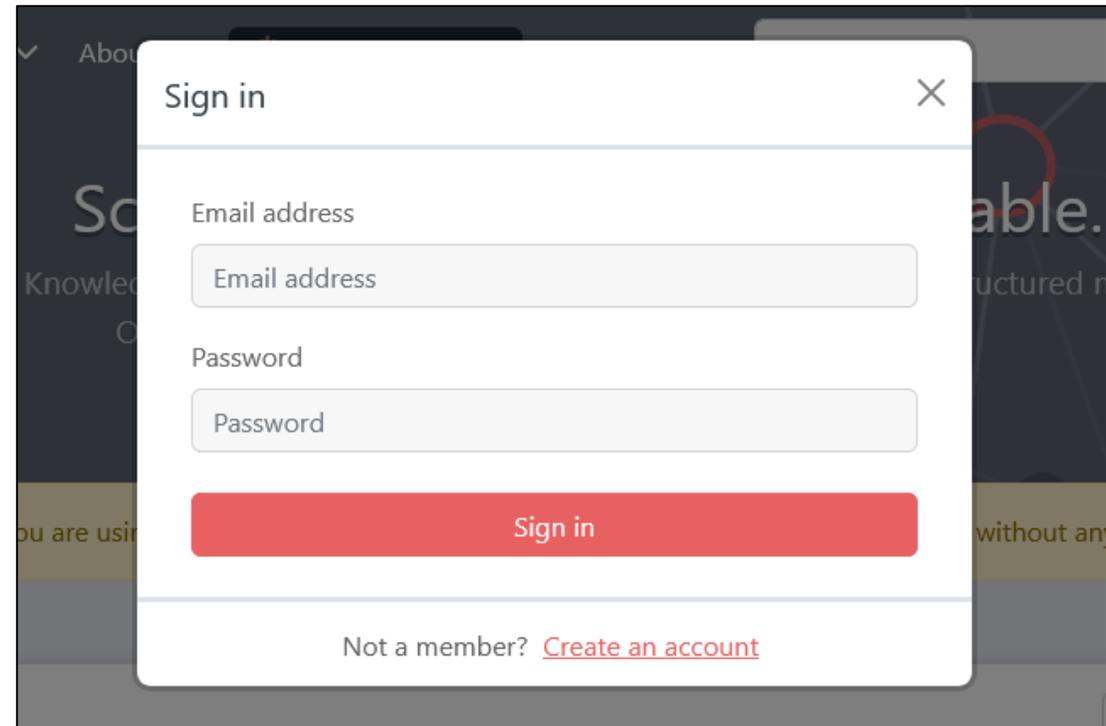
Use <https://sandbox.orkg.org/>!
NOT <https://orkg.org/>!

2. Sign Up & Sign In



The screenshot shows a 'Sign up' modal window with a close button (X) in the top right corner. The form contains the following fields and elements:

- Display name:** A text input field with the placeholder text 'Name'.
- Email address:** A text input field with the placeholder text 'Email address'.
- Password:** A text input field with the placeholder text 'Password'.
- Confirm Password:** A text input field with the placeholder text 'Confirm password'.
- Terms and Conditions:** Two checkboxes with associated text:
 - I accept the [Special Conditions ORKG](#)
 - I agree to the processing of my personal data provided here by Technische Informationsbibliothek (TIB). In accordance with the [data protection declaration](#) as well as the [info sheet data protection](#), the data is processed exclusively by TIB in order to provide services of our platform.
- Sign up button:** A prominent red button with the text 'Sign up'.
- Footer:** The text 'Already a member? [Sign in](#)'.



The screenshot shows a 'Sign in' modal window with a close button (X) in the top right corner. The form contains the following fields and elements:

- Email address:** A text input field with the placeholder text 'Email address'.
- Password:** A text input field with the placeholder text 'Password'.
- Sign in button:** A prominent red button with the text 'Sign in'.
- Footer:** The text 'Not a member? [Create an account](#)'.

3. Add a New Comparison to the ORKG

The screenshot shows the ORKG interface. At the top, there is a search bar with the text "Search..." and a magnifying glass icon, followed by a "+ Add new" button and a user profile picture. A dropdown menu is open, showing three options: "Comparison", "Paper", and "Other". The "Comparison" option is highlighted with a red circle. Below the dropdown, there is a search bar with the text "Search for fields..." and a dropdown arrow. At the bottom, there are three red buttons representing different scientific fields: "Sciences" (181 comparisons), "Physical Sciences & Mathematics" (4276 papers - 514 comparisons), and "Social and Behavioral Sciences" (826 papers - 142 comparisons).

1. Click on “+Add new”
2. Select “Comparison”

Remark:

We could also start by adding individual papers, but since we want to create a comparison at the end, it is easy to start immediately.

4. Go to the Contribution Editor

ORKG View Tools About NFDI4DataScience Search... + Add new

Add comparison

How to make an ORKG comparison - An Example from Virology

Comparisons in ORKG provide an overview of state-of-the-art literature for a particular topic. Comparisons are dynamic and FAIR. A comparison is created from contributions, [view example of comparison](#). To create your own comparisons in ORKG, you can either import existing data (via CSV import) or start from scratch by adding your own contributions. This page guides you in creating new comparisons.

- 1. Existing data**
In case you have existing data, you can import this via the CSV import tool. This is especially helpful if you already have a large file in which related work is compared.
[Go to CSV import tool](#)
- 2. Contribution editor**
If you don't have existing data, go to the contribution editor to add contributions that will be used in the comparison. After creating contributions, you can create a comparisons.
[Go to contribution editor](#)
- 3. Publish comparison**
Once you are done editing contributions, you can create and publish a comparison. Published comparisons are persistent so they are perfectly suitable for publications.
[Publish comparison](#)

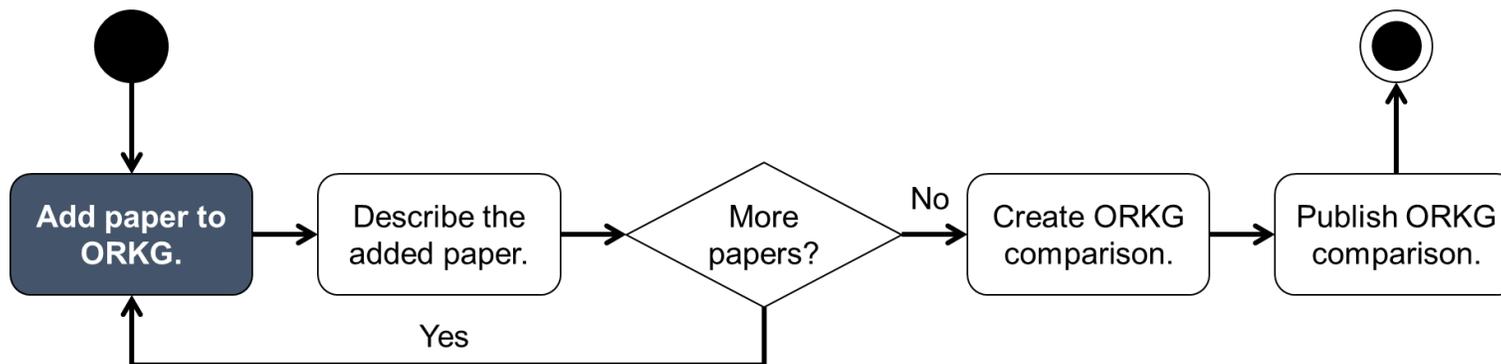
1. Click on “Go to contribution editor”

Remark:

When the data is already extracted, e.g., in a spreadsheet, we could use CSV import tool. However, the tool is a prototype and still requires a lot of manual work to map the data.

5. Add a Paper

The screenshot shows the ORKG Contribution editor interface. At the top left is the ORKG logo. Navigation links include 'View', 'Tools', and 'About'. A dropdown menu is set to 'NFDI4DataScience'. A search bar is on the right, followed by a red '+ Add new' button and a user profile picture. A yellow warning banner reads: 'Warning: You are using a testing environment. Data you enter in the system can be deleted without any notice.' Below this is the 'Contribution editor' section with 'View comparison' and '+ Add contribution' buttons. A light blue instruction box says: 'Start adding contributions by clicking the button *Add contribution* on the right'.



1. Click on “Add contribution”

5. Add a Paper: Enter DOI (or Paper Title)

Add contribution

Paper title or DOI

Search contributions by paper title or DOI...

Select the contributions you want to add or you click on + if you want to create a new contribution for an existing paper

- From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation +
- Environment-Driven Abstraction Identification for Requirements-Based Testing +
- Ambiguity and Generality in Natural Language Privacy Policies +
- On the impact of using different templates on creating and understanding user stories +
- testadas +
 - Contribution 1
 - Contribution 2

[+ Load more](#)

Add contributions

Add contribution

Paper title or DOI

10.1109/RE51729.2021.00009

There are no results, please try a different search term or [Add new paper](#)

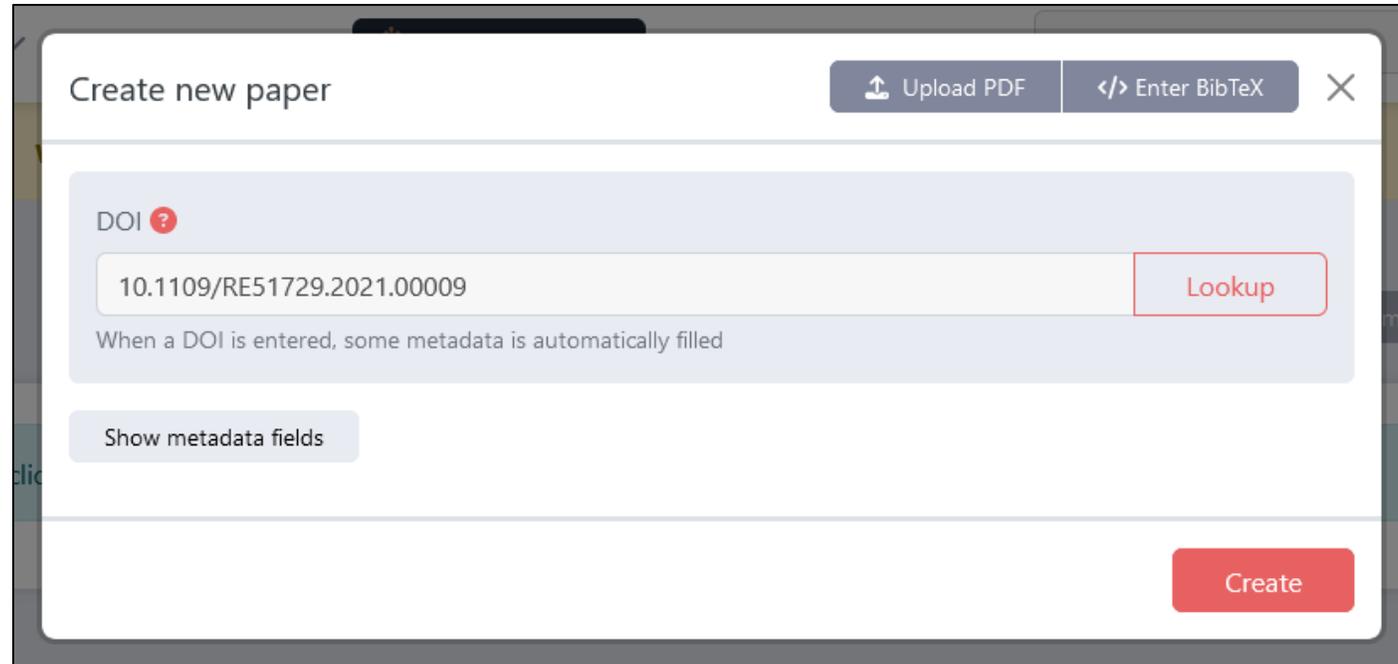
Add contributions

1. Click on “Add new paper”

Remark:

If the paper is already in the ORKG, it is shown and we can either reuse an existing contribution or create a new one.

5. Add a Paper: Lookup Paper by DOI

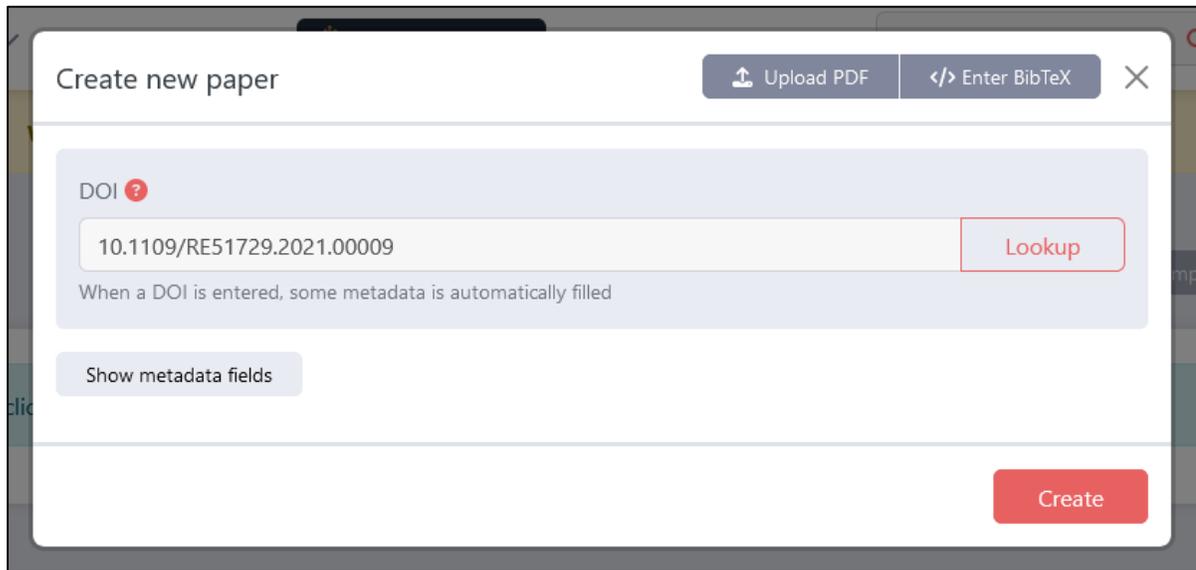


The screenshot shows a web interface for creating a new paper. At the top, there is a title "Create new paper" and two buttons: "Upload PDF" and "Enter BibTeX". Below this is a form with a "DOI" label and a red question mark icon. A text input field contains the DOI "10.1109/RE51729.2021.00009". To the right of the input field is a red "Lookup" button. Below the input field, there is a note: "When a DOI is entered, some metadata is automatically filled". Below the note is a button labeled "Show metadata fields". At the bottom right of the form is a red "Create" button.

Remark:

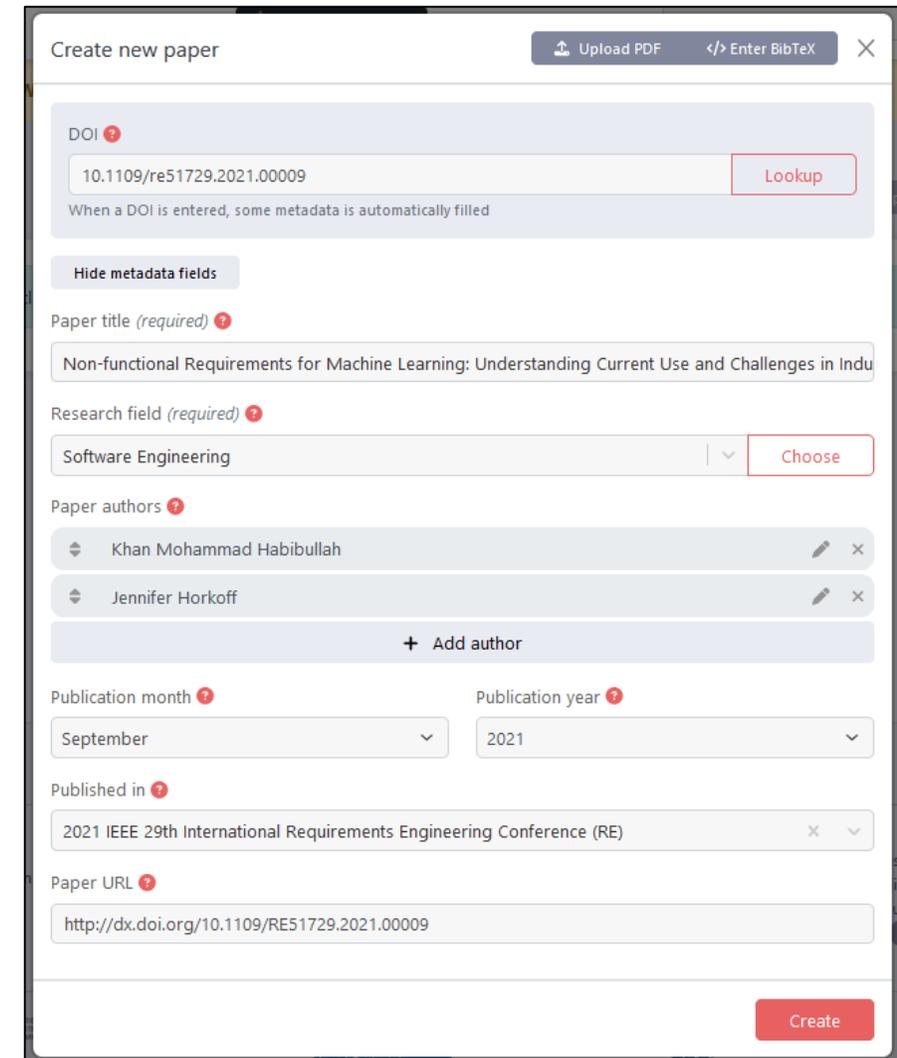
ORKG attempts to retrieve the metadata automatically. If the retrieval is not successful, you can also manually enter or correct the metadata.

5. Add a Paper: Lookup Paper by DOI



The screenshot shows the 'Create new paper' form with the following elements:

- Buttons: 'Upload PDF' and 'Enter BibTeX'.
- Field: 'DOI' with a red question mark icon.
- Input: '10.1109/RE51729.2021.00009'.
- Button: 'Lookup'.
- Text: 'When a DOI is entered, some metadata is automatically filled'.
- Button: 'Show metadata fields'.
- Button: 'Create'.



The screenshot shows the 'Create new paper' form with the following elements:

- Buttons: 'Upload PDF' and 'Enter BibTeX'.
- Field: 'DOI' with a red question mark icon.
- Input: '10.1109/re51729.2021.00009'.
- Button: 'Lookup'.
- Text: 'When a DOI is entered, some metadata is automatically filled'.
- Button: 'Hide metadata fields'.
- Field: 'Paper title (required)' with a red question mark icon.
- Input: 'Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Indu'.
- Field: 'Research field (required)' with a red question mark icon.
- Input: 'Software Engineering'.
- Button: 'Choose'.
- Field: 'Paper authors' with a red question mark icon.
- List of authors: 'Khan Mohammad Habibullah' and 'Jennifer Horkoff', each with edit and delete icons.
- Button: '+ Add author'.
- Field: 'Publication month' with a red question mark icon.
- Input: 'September'.
- Field: 'Publication year' with a red question mark icon.
- Input: '2021'.
- Field: 'Published in' with a red question mark icon.
- Input: '2021 IEEE 29th International Requirements Engineering Conference (RE)'.
- Field: 'Paper URL' with a red question mark icon.
- Input: 'http://dx.doi.org/10.1109/RE51729.2021.00009'.
- Button: 'Create'.

1. Click on “Lookup”
2. Check metadata fetched
3. Add a “Research field”. We use “Software Engineering”.
4. Click on “Create”

6. Describe a Paper

Contribution editor

View comparison | Add contribution

Properties ✓ Saved Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry ✕

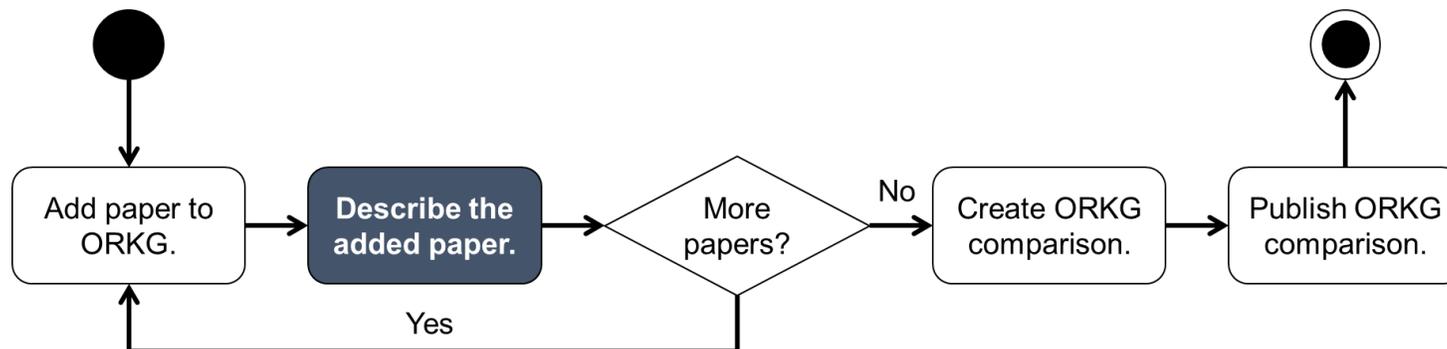
Contribution 1

Start adding properties or use templates by using the buttons below

Add property | Templates

Suggested properties

+ research problem Problem



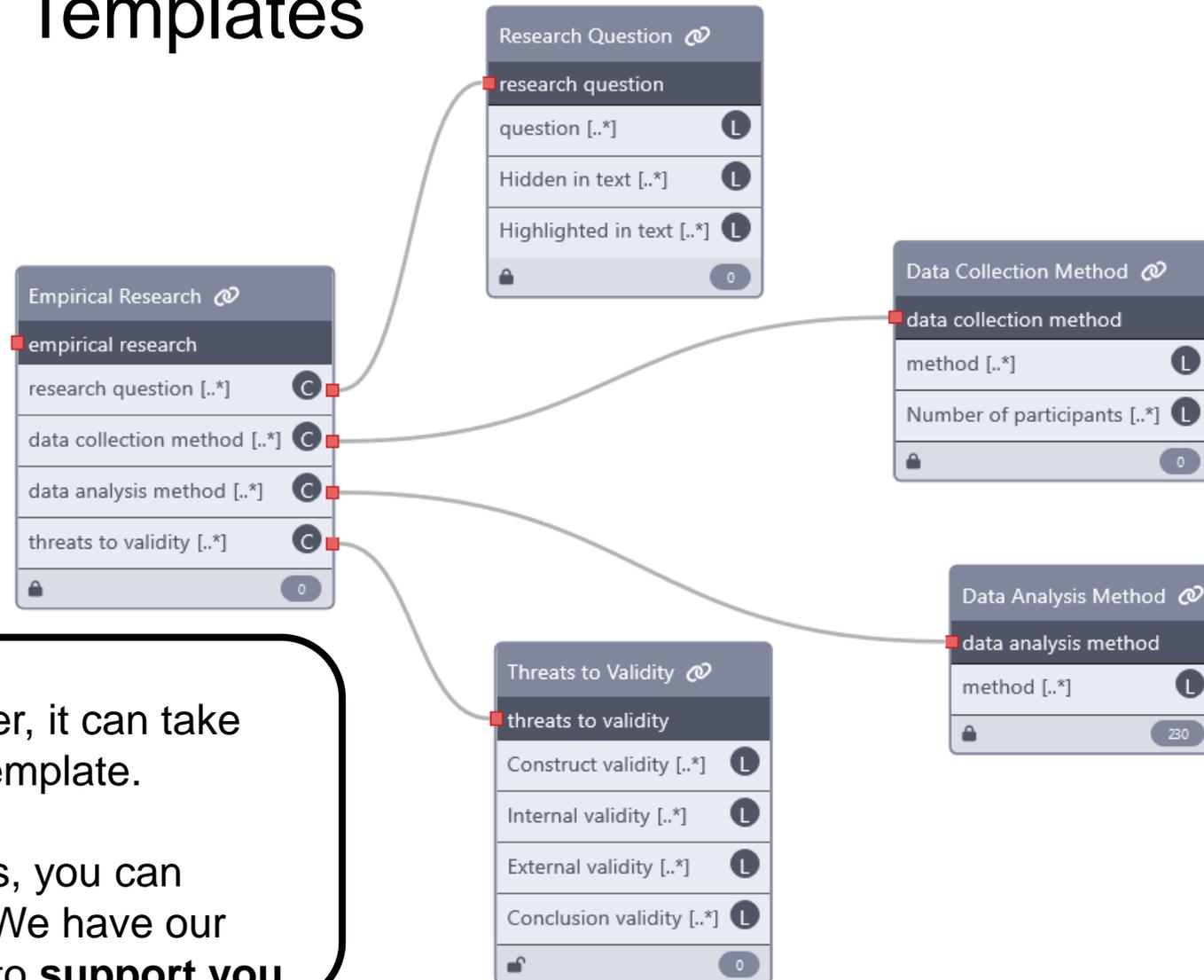
Remark:

Instead of adding all properties individually, we use an ORKG template.

6. Describe a Paper: ORKG Templates

An **ORKG template** specifies the **structure** and **terminology** used to describe a **publication** in the ORKG. Its use **ensures FAIR data** that is **consistent** and **comparable** across publications.

<https://sandbox.orkg.org/template/R369028>

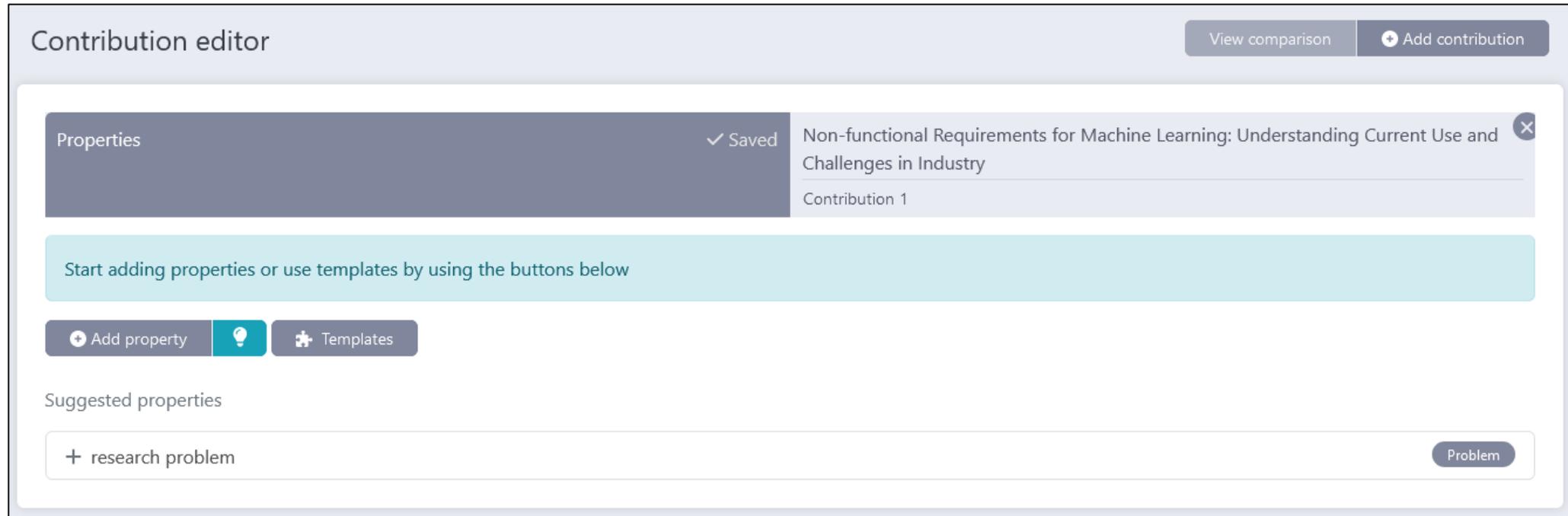


Remark:

Every user can create ORKG templates. However, it can take some time and practice to build a good ORKG template.

If you want to use the feature and have problems, you can always contact the ORKG team, especially me. We have our own **Curation and Community Building team** to **support you**.

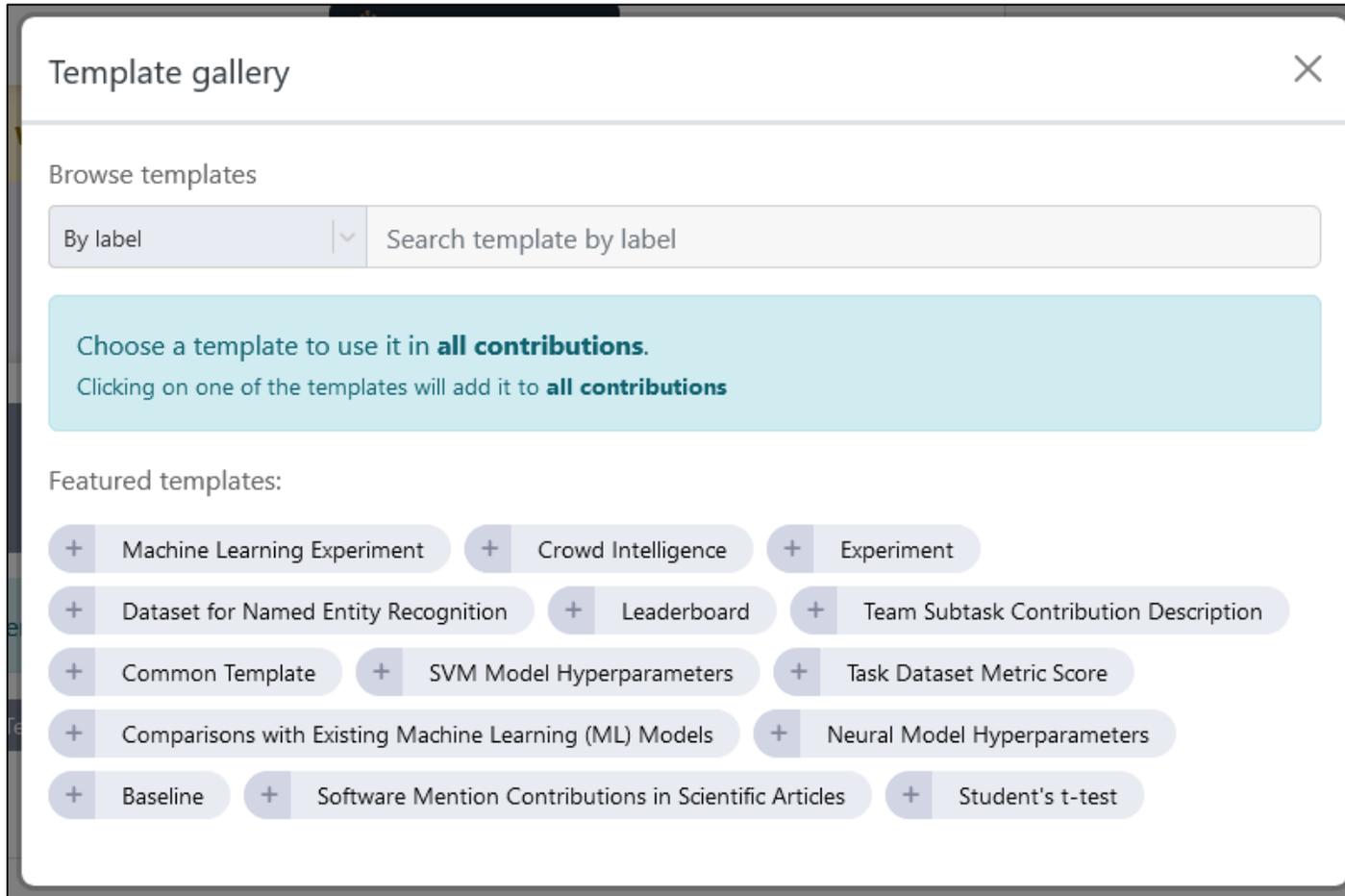
6. Describe a Paper: Add Template “Empirical Research”



The screenshot shows the 'Contribution editor' interface. At the top right, there are two buttons: 'View comparison' and '+ Add contribution'. Below this, a dark grey bar displays 'Properties' on the left, a '✓ Saved' status in the middle, and the title 'Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry' on the right, with a close icon (X) at the far right. Underneath the title, it says 'Contribution 1'. A light blue banner below the title bar contains the text 'Start adding properties or use templates by using the buttons below'. Below the banner are three buttons: '+ Add property' (with a plus icon), a light blue button with a lightbulb icon, and '+ Templates' (with a puzzle piece icon). At the bottom, under the heading 'Suggested properties', there is a search bar containing '+ research problem' and a 'Problem' button on the right.

1. Click on “Templates”

6. Describe a Paper: Add Template “Empirical Research”



Template gallery

Browse templates

By label | Search template by label

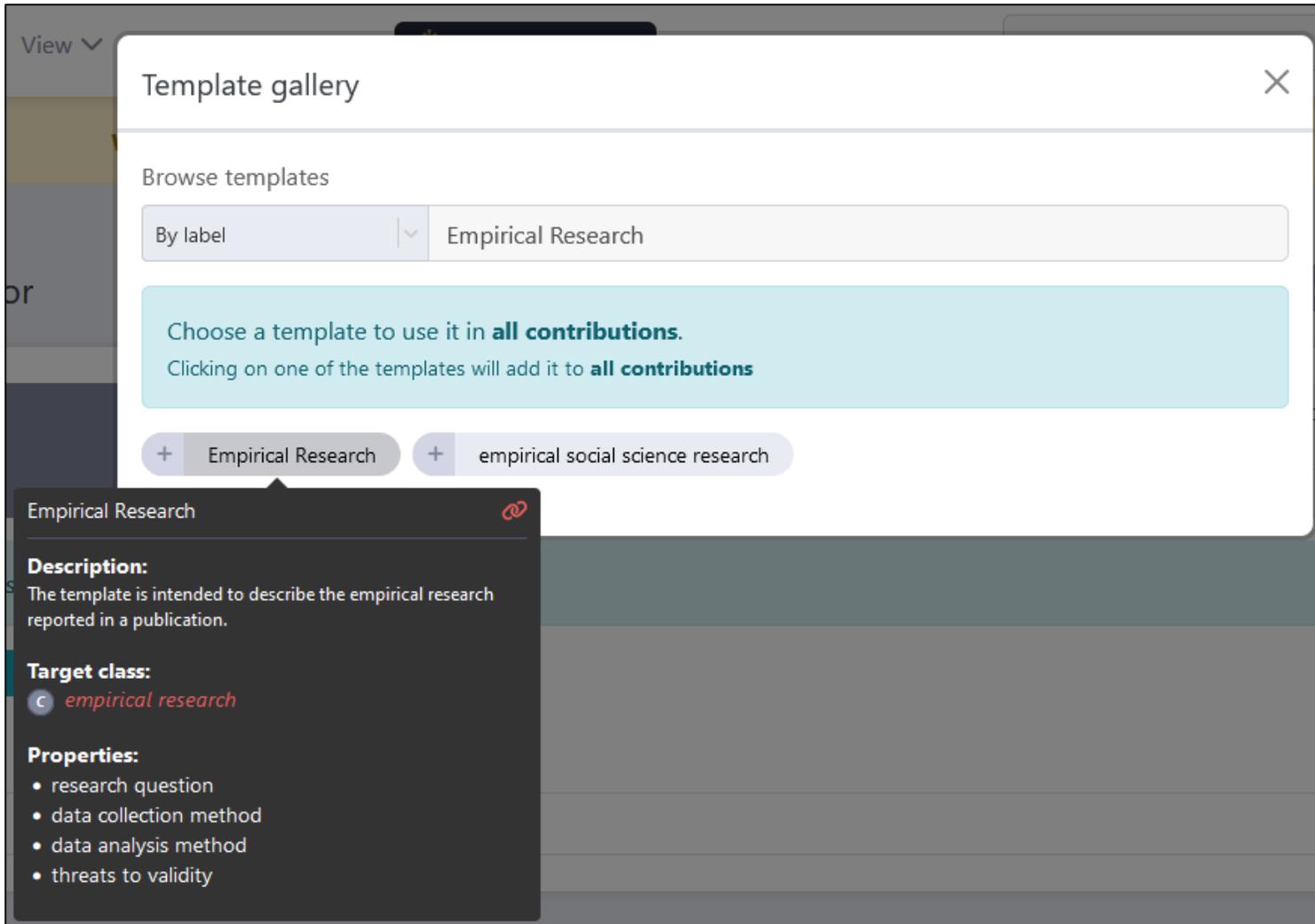
Choose a template to use it in **all contributions**.
Clicking on one of the templates will add it to **all contributions**

Featured templates:

- + Machine Learning Experiment
- + Crowd Intelligence
- + Experiment
- + Dataset for Named Entity Recognition
- + Leaderboard
- + Team Subtask Contribution Description
- + Common Template
- + SVM Model Hyperparameters
- + Task Dataset Metric Score
- + Comparisons with Existing Machine Learning (ML) Models
- + Neural Model Hyperparameters
- + Baseline
- + Software Mention Contributions in Scientific Articles
- + Student's t-test

1. Search for “Empirical Research”

6. Describe a Paper: Add Template “Empirical Research”



The screenshot shows a 'Template gallery' window with a search bar containing 'Empirical Research'. Below the search bar, there is a light blue instruction box: 'Choose a template to use it in **all contributions**. Clicking on one of the templates will add it to **all contributions**'. At the bottom of the gallery, two template buttons are visible: '+ Empirical Research' and '+ empirical social science research'. A tooltip is open over the 'Empirical Research' button, displaying the following information:

Empirical Research 

Description:
The template is intended to describe the empirical research reported in a publication.

Target class:
 *empirical research*

Properties:

- research question
- data collection method
- data analysis method
- threats to validity

1. Select “Empirical Research”

6. Describe a Paper: Fill out the Table

The screenshot shows the 'Contribution editor' interface. At the top right, there are buttons for 'View comparison' and '+ Add contribution'. The main area is a table with a dark grey header row containing 'Properties' and '✓ Saved'. The table title is 'Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry'. The table has one row labeled 'Contribution 1'. The first column of the table lists properties: 'data analysis method', 'data collection method', 'research question', and 'threats to validity'. The second column is empty, with a tooltip 'Add value' and a '+' icon pointing to it. Below the table, there are buttons for '+ Add property', a lightbulb icon, and '+ Templates'. At the bottom, there is a section for 'Suggested properties' with a button '+ research problem' and a 'Problem' label.

Properties	✓ Saved
Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry	
Contribution 1	
data analysis method	
data collection method	
research question	
threats to validity	

+ Add property + Templates

Suggested properties

+ research problem Problem

1. Click “Add value” for adding the data analysis method

6. Describe a Paper: Enter the Data Analysis Method(s)

The screenshot shows the ORKG Contribution editor interface. A modal window titled "View existing resource: Data Analysis Method" is open, displaying the "Applied template: Data Analysis Method" and a text input field containing the word "method". The background interface includes a "Properties" sidebar with links like "data_analysis_method", "data_collection_method", "research_question", and "threats_to_validity", and a "Suggested properties" section with a "research problem" option.

1. Click the +
2. Enter method

6. Describe a Paper: Enter the Data Analysis Method(s)

The screenshot shows the ORKG Contribution editor interface. A modal dialog box titled "View existing resource: Data Analysis Method" is open. The dialog has a close button (X) and an "Open resource" link. It contains a "Templates" button, a "Help" button, and a "Preferences" button. Below these is a section for the "Applied template: Data Analysis Method". The main input area shows a dropdown menu with "method" selected, a text input field containing "thematic analysis", and a "Text" dropdown. To the right of the text input are "Cancel" and "Create" buttons. At the bottom of the dialog is a "+ Add property" button. The background shows the "Contribution editor" with a "Properties" panel on the left containing links for "data analysis method", "data collection method", "research question", and "threats to validity". A "Suggested properties" section at the bottom left shows a "+ research problem" button. The top right of the editor has a "+ Add new" button and a user profile icon.

1. Click “Create”
2. Close dialog

6. Describe a Paper: Enter the Data Analysis Method(s)

The screenshot shows the ORKG Contribution editor interface. At the top, there is a navigation bar with the ORKG logo, menu items (View, Tools, About), a user profile dropdown (NFDI4DataScience), a search bar, and a '+ Add new' button. A yellow warning banner states: "Warning: You are using a testing environment. Data you enter in the system can be deleted without any notice." Below this is the 'Contribution editor' section, which includes a 'View comparison' button and a '+ Add contribution' button. The main editing area is divided into two columns. The left column, titled 'Properties', contains a list of property labels: 'data analysis method', 'data collection method', 'research question', and 'threats to validity'. The right column shows the title 'Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry' and 'Contribution 1'. The 'data analysis method' field is highlighted in red and contains the text 'thematic analysis'. At the bottom of the editor, there are buttons for '+ Add property', a lightbulb icon, and '+ Templates'. Below the editor is a 'Suggested properties' section with a search bar containing '+ research problem' and a 'Problem' button.

If you have more analysis methods, **repeat** the process.

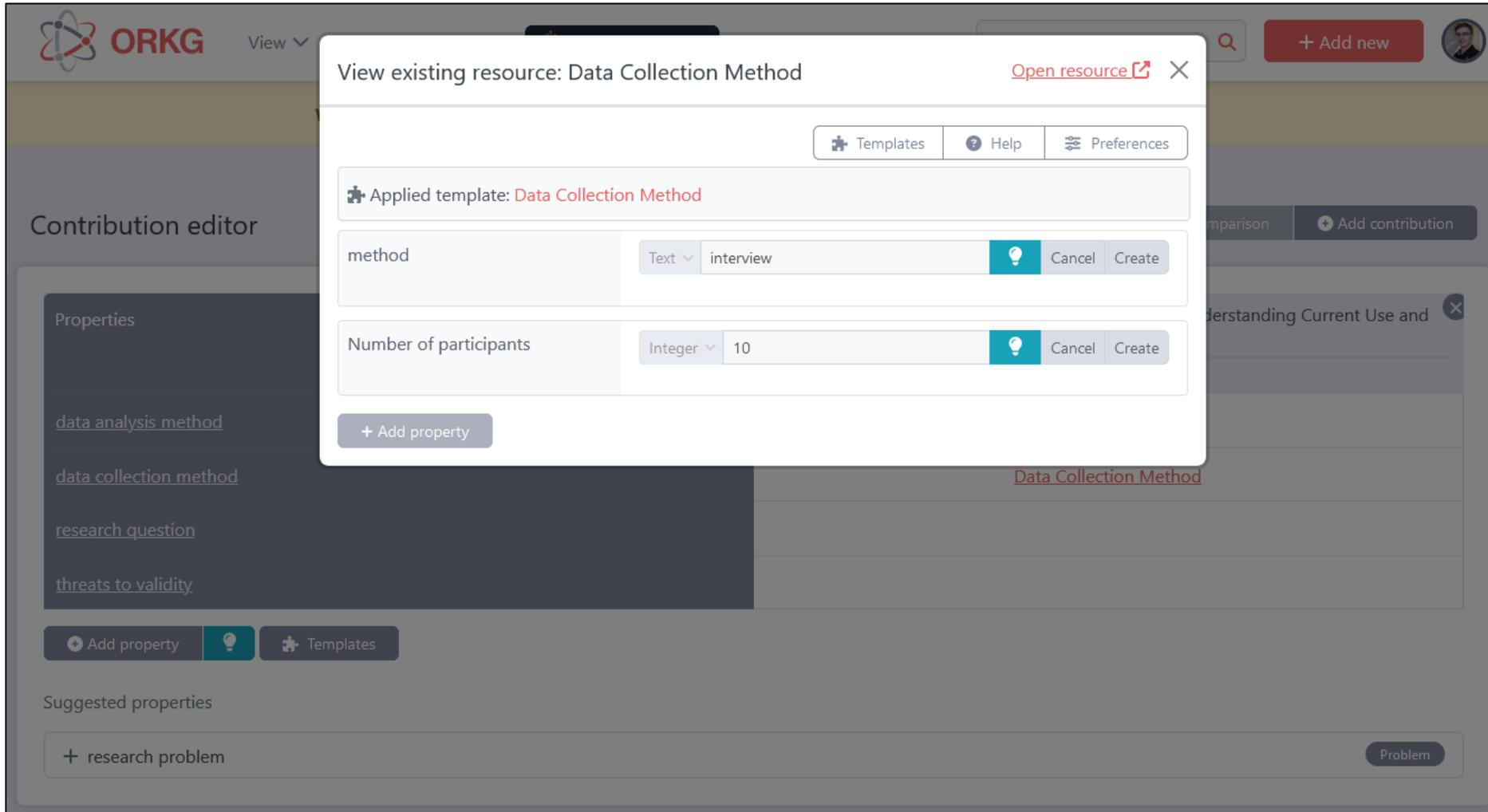
Otherwise, continue with the next property.

6. Describe a Paper: Enter the Data Collection Method(s)

The screenshot shows the ORKG Contribution editor interface. A modal dialog box titled "View existing resource: Data Collection Method" is open. The dialog has a search bar at the top, a "Templates" button, and a "Help" button. Below the search bar, it shows "Applied template: Data Collection Method". There are two input fields: "method" and "Number of participants", each with a "+" button to its right. At the bottom of the dialog is a "+ Add property" button. The background shows the "Contribution editor" with a "Properties" panel on the left containing links for "data analysis method", "data collection method", "research question", and "threats to validity". At the bottom, there is a "Suggested properties" section with a "+ research problem" button and a "Problem" label.

1. Click the +
2. Enter method
3. Click the +
4. Enter number of participants

6. Describe a Paper: Enter the Data Collection Method(s)



The screenshot shows the ORKG Contribution editor interface. A modal dialog titled "View existing resource: Data Collection Method" is open. The dialog has a title bar with "Open resource" and a close button. Below the title bar are three buttons: "Templates", "Help", and "Preferences". The main content of the dialog shows an "Applied template: Data Collection Method" section. Below this, there are two input fields. The first is labeled "method" and has a dropdown menu set to "Text" and a text input field containing "interview". The second is labeled "Number of participants" and has a dropdown menu set to "Integer" and a text input field containing "10". Each input field has a lightbulb icon, a "Cancel" button, and a "Create" button. At the bottom of the dialog is a "+ Add property" button. The background shows the "Contribution editor" with a "Properties" panel on the left containing links for "data analysis method", "data collection method", "research question", and "threats to validity". There is also a "Suggested properties" section with a "+ research problem" button.

1. Click “Create”
2. Click “Create”
3. Close dialog

6. Describe a Paper: Enter the Data Collection Method(s)

The screenshot shows the ORKG Contribution editor interface. At the top, there is a navigation bar with the ORKG logo, menu items (View, Tools, About), a user profile icon, and a search bar. A yellow warning banner states: "Warning: You are using a testing environment. Data you enter in the system can be deleted without any notice." Below this is the "Contribution editor" section, which includes a "View comparison" button and an "Add contribution" button. The main editing area is a table with a left sidebar for properties and a right column for the contribution content.

Properties	Contribution 1
data analysis method	thematic analysis
data collection method	interview
research question	
threats to validity	

Below the table, there are buttons for "Add property", "Templates", and "Suggested properties". A "research problem" suggestion is visible at the bottom.

If you have more collection methods, **repeat** the process.

Otherwise, continue with the next property.

6. Describe a Paper: Enter the Research Question(s)

View existing resource: Research Question [Open resource](#) ✕

Templates Help Preferences

Applied template: Research Question

question +

Hidden in text +

Highlighted in text +

+ Add property

Contribution editor

Properties

- [data analysis method](#)
- [data collection method](#)
- [research question](#)
- [threats to validity](#)

+ Add property + Templates

Suggested properties

+ research problem Problem

1. Click the +
2. Enter question
3. Click the +
4. Enter, if the question is hidden in text
5. Click the +
6. Enter, if the question is highlighted in text

6. Describe a Paper: Enter the Research Question(s)

The screenshot shows the ORKG Contribution editor interface. A modal dialog titled "View existing resource: Research Question" is open. The dialog has a header with "Open resource" and a close button. Below the header are three buttons: "Templates", "Help", and "Preferences". A section labeled "Applied template: Research Question" contains three property fields:

- question**: A text field with a dropdown menu set to "Text" and the value "nt treatment of NFRs in ML in industry?". It has a lightbulb icon, a "Cancel" button, and a "Create" button.
- Hidden in text**: A Boolean field with a dropdown menu set to "Boolean" and the value "False". It has a lightbulb icon, a "Cancel" button, and a "Create" button.
- Highlighted in text**: A Boolean field with a dropdown menu set to "Boolean" and the value "True". It has a lightbulb icon, a "Cancel" button, and a "Create" button.

At the bottom of the dialog is a "+ Add property" button. The background shows the "Contribution editor" with a "Properties" sidebar containing links for "data analysis method", "data collection method", "research question", and "threats to validity". There are also "Add property" and "Templates" buttons at the bottom of the editor.

1. Click "Create"
2. Click "Create"
3. Click "Create"
4. Close dialog

6. Describe a Paper: Enter the Research Question(s)

The screenshot shows the ORKG Contribution editor interface. At the top, there is a navigation bar with the ORKG logo, menu items (View, Tools, About), a user profile dropdown (NFDI4DataScience), a search bar, and a '+ Add new' button. A yellow warning banner states: "Warning: You are using a testing environment. Data you enter in the system can be deleted without any notice." Below this is the 'Contribution editor' section with 'View comparison' and '+ Add contribution' buttons. The main area is a table with a 'Properties' column on the left and a 'Value' column on the right. The 'research question' property is selected and contains the text: "What is the perception and current treatment of NFRs in ML in industry?". Below the table are buttons for '+ Add property', a lightbulb icon, and '+ Templates'. At the bottom, there is a 'Suggested properties' section with a '+ research problem' button and a 'Problem' button.

Properties	Value
data analysis method	thematic analysis
data collection method	interview
research question	What is the perception and current treatment of NFRs in ML in industry?
threats to validity	

If you have more research questions, **repeat** the process.

Otherwise, continue with the next property.

6. Describe a Paper: Enter the Threats to Validity

The screenshot shows the ORKG Contribution editor interface. A modal window titled "View existing resource: Threats to Validity" is open, displaying a list of validity types with plus signs for adding them:

- Construct validity
- Internal validity
- External validity
- Conclusion validity

The background interface includes the ORKG logo, a search bar, a "+ Add new" button, and a list of properties: "data analysis method", "data collection method", "research question", and "threats to validity".

1. Click the +
2. Enter construct validity
3. Click the +
4. Enter internal validity
5. Click the +
6. Enter external validity
7. Click the +
8. Enter conclusion validity

6. Describe a Paper: Enter the Threats to Validity

The screenshot shows the ORKG Contribution editor interface. A modal dialog titled "View existing resource: Threats to Validity" is open. The dialog has a header with "Open resource" and a close button. Below the header are buttons for "Templates", "Help", and "Preferences". The main content area shows "Applied template: Threats to Validity". There are four rows of properties, each with a "Boolean" dropdown set to "True", a lightbulb icon, and "Cancel" and "Create" buttons. The background shows the "Contribution editor" with a "Properties" list on the left and "Suggested properties" at the bottom.

1. Click “Create”
2. Click “Create”
3. Click “Create”
4. Click “Create”
5. Close dialog

6. Describe a Paper: Enter the Threats to Validity

The screenshot shows the ORKG Contribution editor interface. At the top, there is a navigation bar with the ORKG logo, menu items (View, Tools, About), a user profile icon, and a search bar. A yellow warning banner states: "Warning: You are using a testing environment. Data you enter in the system can be deleted without any notice." Below this is the "Contribution editor" header with "View comparison" and "Add contribution" buttons. The main content area is a table with a left sidebar for properties and a right column for values. The "threats to validity" property is selected and contains the text: "Construct validity: true, Internal validity: true, External validity: true, Conclusion validity: true". Other properties include "data analysis method" (thematic analysis), "data collection method" (interview), and "research question" (What is the perception and current treatment of NFRs in ML in industry?). At the bottom, there are buttons for "Add property", "Templates", and "Suggested properties" (research problem).

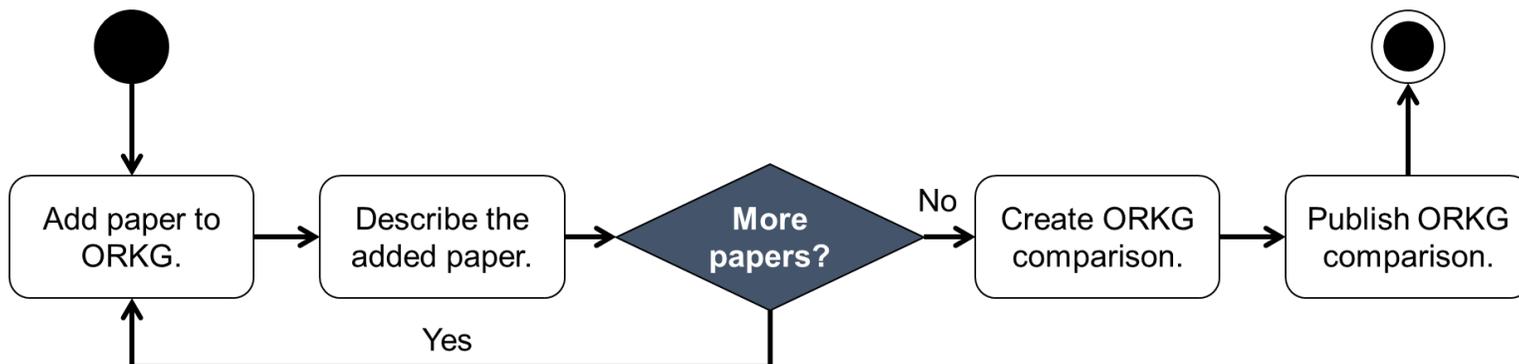
Properties	Values
data analysis method	thematic analysis
data collection method	interview
research question	What is the perception and current treatment of NFRs in ML in industry?
threats to validity	Construct validity: true, Internal validity: true, External validity: true, Conclusion validity: true

Now, we have described our first paper regarding its reported empirical research.

We can repeat the entire process for the next paper or work collaboratively!

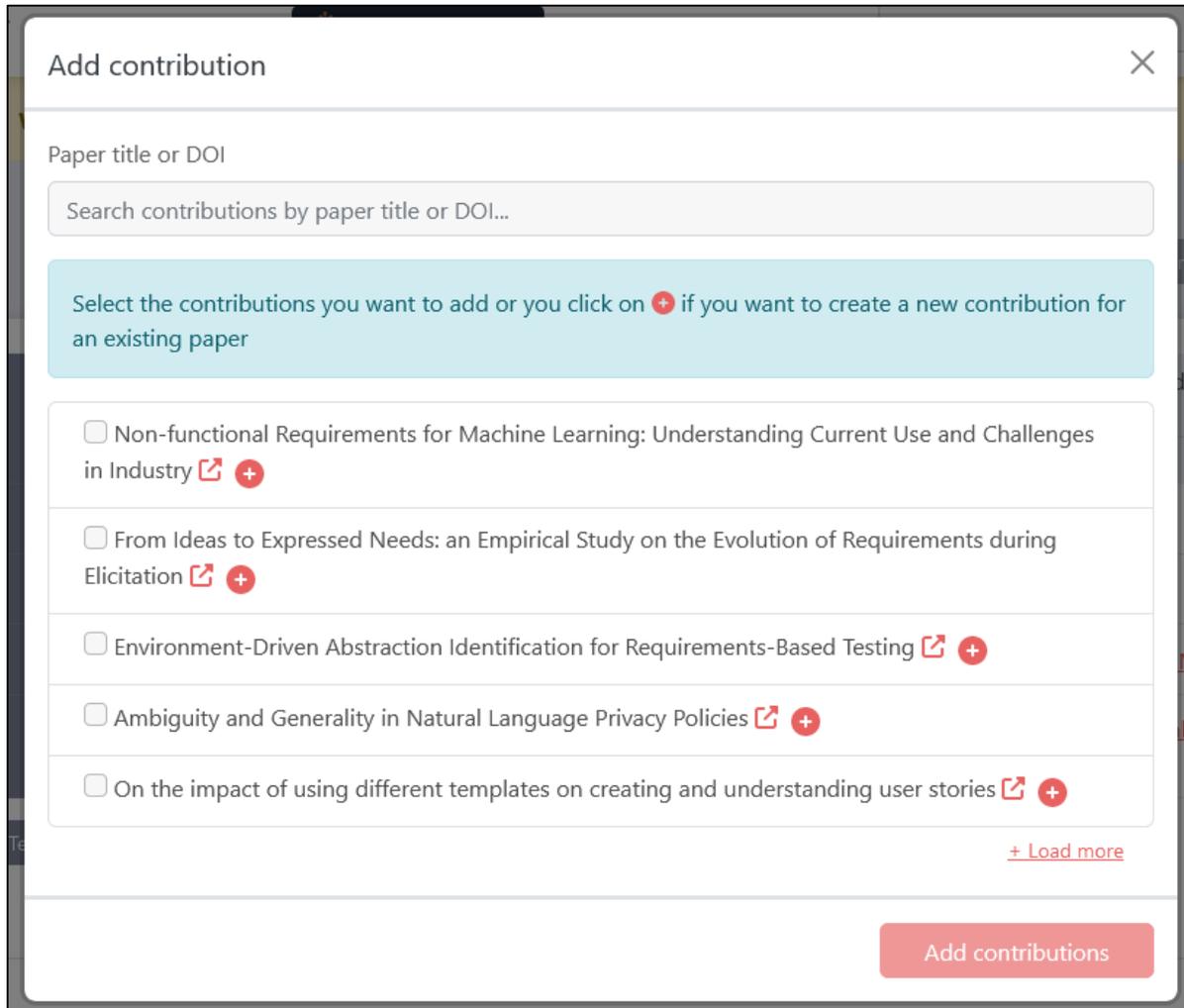
7. Add the Next Paper

1. Click on “Add contribution”



Remark:
Now, we use a paper called **“From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation”** already described with the ORKG template.

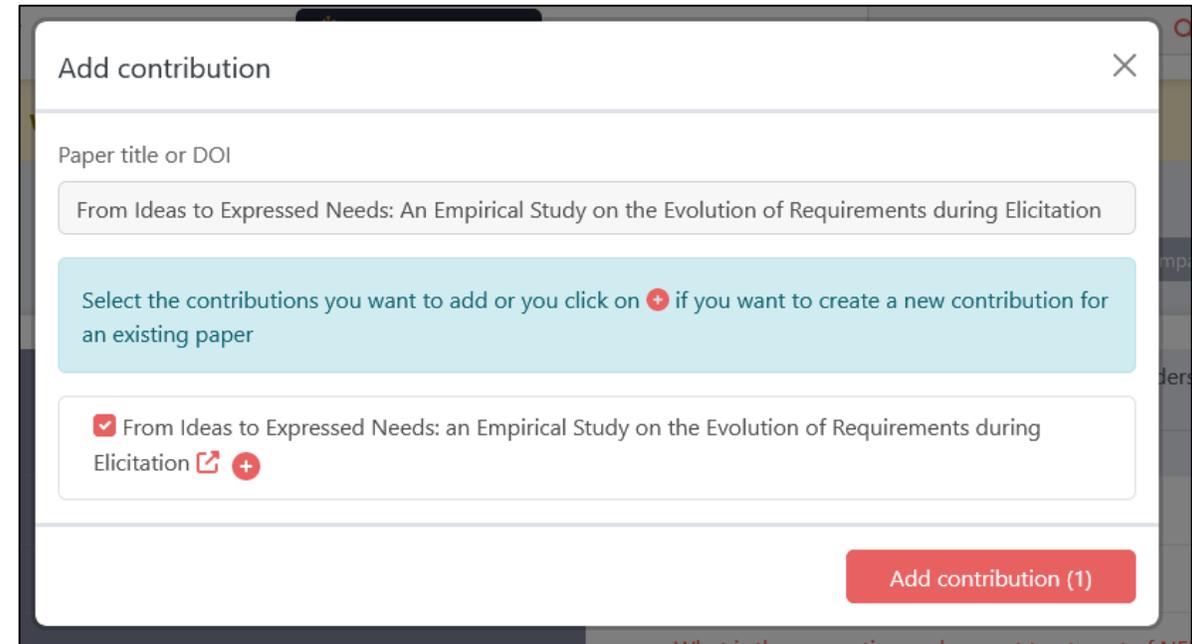
7. Add the Next Paper: Enter Paper Title



The screenshot shows a dialog box titled "Add contribution" with a close button (X) in the top right corner. Below the title is a search bar labeled "Paper title or DOI" with the placeholder text "Search contributions by paper title or DOI...". A light blue instruction box states: "Select the contributions you want to add or you click on + if you want to create a new contribution for an existing paper". Below this is a list of five papers, each with an unchecked checkbox, a red square icon containing a white plus sign, and a red circle icon containing a white plus sign:

- Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry
- From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation
- Environment-Driven Abstraction Identification for Requirements-Based Testing
- Ambiguity and Generality in Natural Language Privacy Policies
- On the impact of using different templates on creating and understanding user stories

At the bottom right of the list is a red link "+ Load more". At the bottom center of the dialog is a red button labeled "Add contributions".



This screenshot shows the same "Add contribution" dialog box, but with the checkbox for the second paper selected. The checkbox is now checked, and the red square icon with a white plus sign is now a red circle with a white plus sign. The red button at the bottom right now reads "Add contribution (1)".

1. Enter paper title
2. Select the checkbox
3. Click "Add contribution (1)"

7. Add the Next Paper: Result

Contribution editor
View comparison
+ Add contribution

	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry ✕	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation ✕
Properties ✓ Saved	Contribution 1	Contribution 1
data analysis method	thematic analysis	thematic analysis inferential statistics descriptive statistics
data collection method	interview	experiment
research question	What is the perception and current treatment of NFRs in ML in industry?	What is the relevance given to the different categories of requirements and roles with respect to initial Ideas? What is the relevance given to the different categories of requirements and roles with respect to initial Ideas? How much is the difference in terms of documented requirements and roles with respect to initial ideas? +
threats to validity	Construct validity: true, Internal validity: true, External validity: true, Conclusion validity: true	Construct validity: true, Internal validity: true, External validity: true, Conclusion validity: false

Now, we have two described papers.

If we want, we can add further ones or we can create an ORKG comparison.

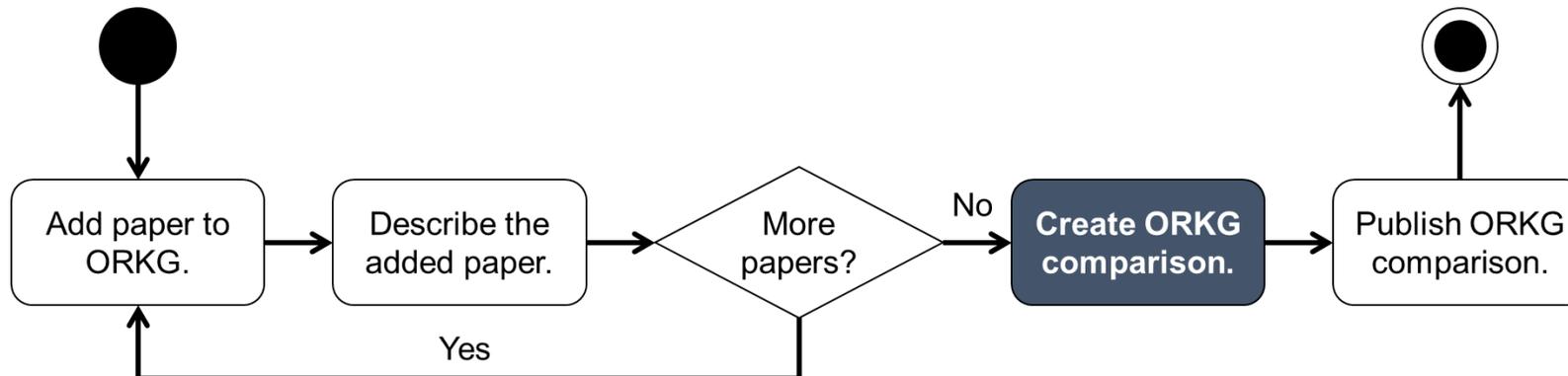
8. Create ORKG Comparison

Contribution editor

View comparison Add contribution

Properties	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation
	Contribution 1	Contribution 1
data analysis method	thematic analysis	thematic analysis inferential statistics descriptive statistics
data collection method	interview	experiment
research question	What is the perception and current treatment of NFRs in ML in industry?	What is the relevance given to the different categories of requirements and roles with respect to initial Ideas? What is the relevance given to the different categories of requirements and roles with respect to initial Ideas? How much is the difference in terms of documented requirements and roles with respect to initial ideas?
threats to validity	Construct validity: true, Internal validity: true, External validity: true, Conclusion validity: true	Construct validity: true, Internal validity: true, External validity: true, Conclusion validity: false

1. Click on “View comparison”



8. Create ORKG Comparison: Result and Improvements

Properties	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry Contribution 1 - 2021	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation Contribution 1 - 2021
data.analysis.method	Data Analysis Method	Data Analysis Method
data.analysis.method/data.analysis.method/method*	thematic analysis	descriptive statistics inferential statistics thematic analysis
data.collection.method	Data Collection Method	Data Collection Method
data.collection.method/data.collection.method		
method*	interview	experiment
number.of.participants*	10	30
research.question	Research Question	Research Question
research.question/research.question		
hidden.in.text*	✗	✗
highlighted.in.text*	✓	✓
question*	What is the perception and current treatment of NFRs in ML in industry?	How much is the difference in terms of documented requirements and roles with respect to initial ideas? What is the relevance given to the different categories of requirements and roles with respect to initial ideas? What is the relevance given to the different categories of requirements and roles with respect to initial ideas?
threats.to.validity	Threats to Validity	Threats to Validity
threats.to.validity/threats.to.validity		
conclusion.validity*	✓	✗
construct.validity*	✓	✓
external.validity*	✓	✓
internal.validity*	✓	✓

Now, we created our ORKG comparison.

Options before publishing the ORKG comparison:

1. Edit the ORKG comparison by ordering the rows
Edit → Drag & Drop the property cells as required
2. Select properties we want to show.
Actions → Select properties → Disable checkboxes of properties to hide
3. Save ORKG comparison as a draft for later
Actions → Save as draft → Enter title → Save → Draft in “My account”

9. Improve ORKG Comparison: Order Rows

Comparison | 2 contributions

Properties	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry Contribution 1 - 2021	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation Contribution 1 - 2021
data.analysis.method	Data Analysis Method	Data Analysis Method
data.analysis.method/data.analysis.method/method*	thematic analysis	descriptive statistics
		inferential statistics
		thematic analysis
data.collection.method	Data Collection Method	Data Collection Method
data.collection.method/data.collection.method		
method*	interview	experiment
number.of.participants*	10	30
research.question	Research Question	Research Question
		Research Question
		Research Question
research.question/research.question		
hidden.in.text*	✗	✗
		✗
		✗
highlighted.in.text*	✓	✓
		✓
		✓
question*	What is the perception and current treatment of NFRs in ML in industry?	How much is the difference in terms of documented requirements and roles with respect to initial ideas?
		What is the relevance given to the different categories of requirements and roles with respect to initial ideas?
		What is the relevance given to the different categories of requirements and roles with respect to initial ideas?
threats.to.validity	Threats to Validity	Threats to Validity
threats.to.validity/threats.to.validity		
conclusion.validity*	✓	✗
construct.validity*	✓	✓
external.validity*	✓	✓
internal.validity*	✓	✓

ORKG | View | Tools | About | NFDI4DataScience

Search... + Add new

Comparison | 2 contributions

Stop editing | Add contribution | Visualize | Actions

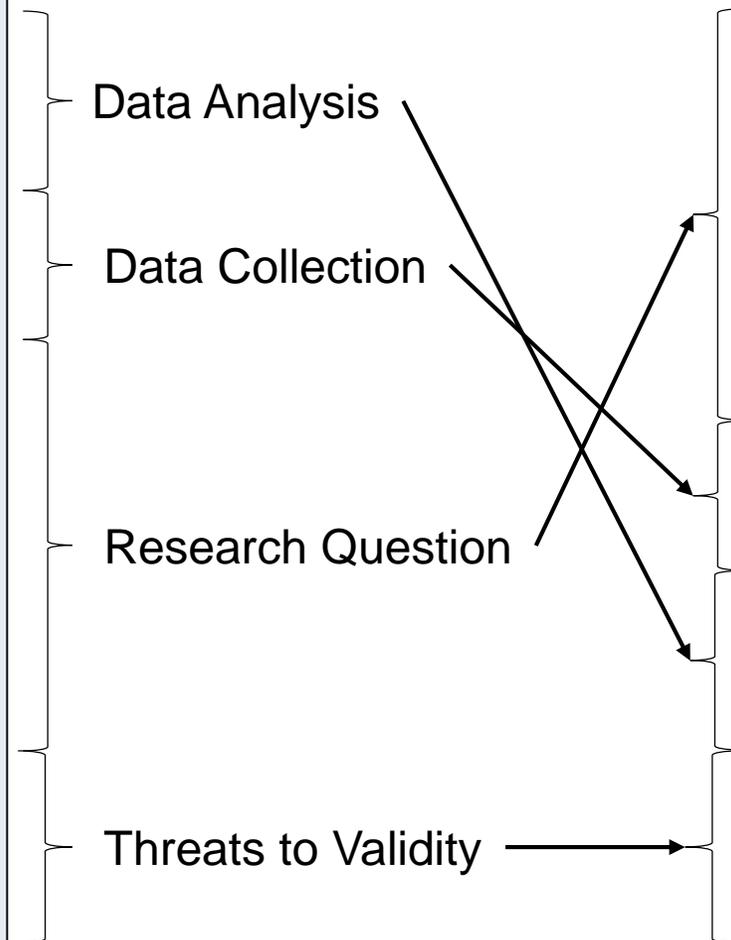
Edit mode

Properties	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry Contribution 1 - 2021	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation Contribution 1 - 2021
research.question		
data.analysis	Data Analysis Method	Data Analysis Method
		Data Analysis Method
		Data Analysis Method
data.analysis.method/data.analysis.method/method*	thematic analysis	descriptive statistics
		inferential statistics
		thematic analysis

1. Click on “Edit”
2. Click on the grey property cell you want to move
3. Drag & Drop the property cell where you want

9. Improve ORKG Comparison: Order Rows – Result

Properties	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry Contribution 1 - 2021	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation Contribution 1 - 2021
data_analysis_method	Data Analysis Method	Data Analysis Method
data_analysis_method/data_analysis_method/method*	thematic analysis	Data Analysis Method descriptive statistics inferential statistics thematic analysis
data_collection_method	Data Collection Method	Data Collection Method
data_collection_method/data_collection_method		
↳ method*	interview	experiment
↳ number_of_participants*	10	30
research_question	Research Question	Research Question
research_question/research_question		Research Question
↳ hidden_in_text*	✗	✗
↳ highlighted_in_text*	✓	✗
↳ question*	What is the perception and current treatment of NFRs in ML in industry?	How much is the difference in terms of documented requirements and roles with respect to initial ideas? What is the relevance given to the different categories of requirements and roles with respect to initial ideas? What is the relevance given to the different categories of requirements and roles with respect to initial ideas?
threats_to_validity	Threats to Validity	Threats to Validity
threats_to_validity/threats_to_validity		
↳ conclusion_validity*	✓	✗
↳ construct_validity*	✓	✓
↳ external_validity*	✓	✓
↳ internal_validity*	✓	✓

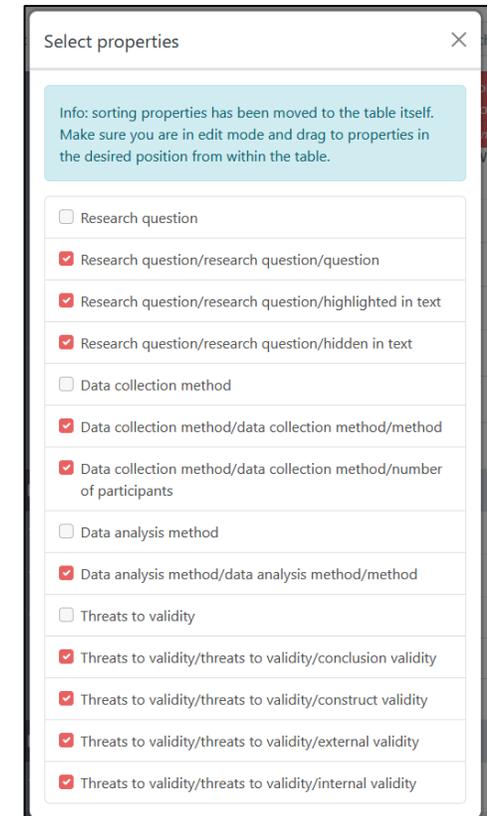
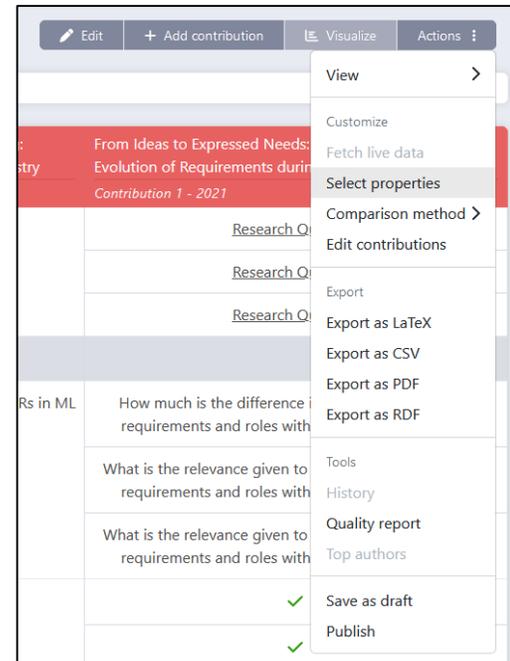


Properties	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry Contribution 1 - 2021	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation Contribution 1 - 2021
research_question	Research Question	Research Question
research_question/research_question		Research Question
↳ question*	What is the perception and current treatment of NFRs in ML in industry?	How much is the difference in terms of documented requirements and roles with respect to initial ideas?
↳ highlighted_in_text*	✓	✓
↳ hidden_in_text*	✗	✗
↳ method*	interview	experiment
↳ number_of_participants*	10	30
data_analysis_method	Data Analysis Method	Data Analysis Method
data_analysis_method/data_analysis_method/method*	thematic analysis	Data Analysis Method descriptive statistics inferential statistics thematic analysis
threats_to_validity	Threats to Validity	Threats to Validity
threats_to_validity/threats_to_validity		
↳ conclusion_validity*	✓	✗
↳ construct_validity*	✓	✓
↳ external_validity*	✓	✓
↳ internal_validity*	✓	✓

9. Improve ORKG Comparison: Select Properties

Comparison | 2 contributions

Properties	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry Contribution 1 - 2021	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation Contribution 1 - 2021
research question	Research Question	Research Question
research question/research question		
question*	What is the perception and current treatment of NFRs in ML in industry?	How much is the difference in terms of documented requirements and roles with respect to initial ideas? What is the relevance given to the different categories of requirements and roles with respect to initial Ideas? What is the relevance given to the different categories of requirements and roles with respect to initial Ideas?
highlighted in text	✓	✓ ✓ ✓
hidden in text	✗	✗ ✗ ✗
data collection method	Data Collection Method	Data Collection Method
data collection method/data collection method		
method*	interview	experiment
number of participants*	10	30
data analysis method	Data Analysis Method	Data Analysis Method
data analysis method/data analysis method/method*	thematic analysis	descriptive statistics inferential statistics thematic analysis
threats to validity	Threats to Validity	Threats to Validity
threats to validity/threats to validity		
conclusion validity*	✓	✗
construct validity*	✓	✓
external validity*	✓	✓
internal validity*	✓	✓



1. Click on “Actions”
2. Click on “Select properties”
3. Disable all checkboxes of properties you want to hide
4. Close dialog

9. Improve ORKG Comparison: Select Properties – Result

Comparison | 2 contributions

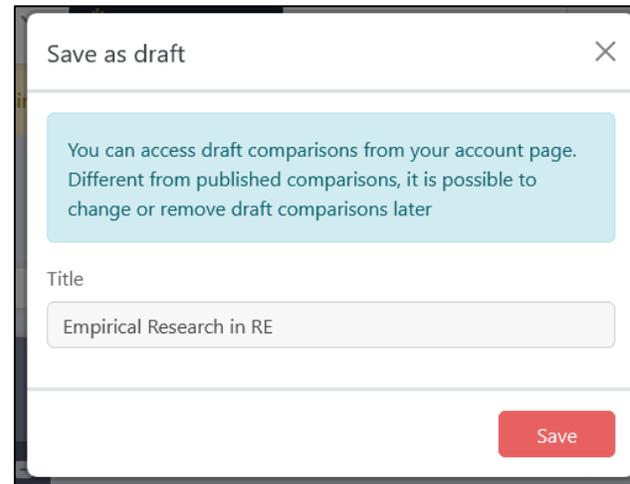
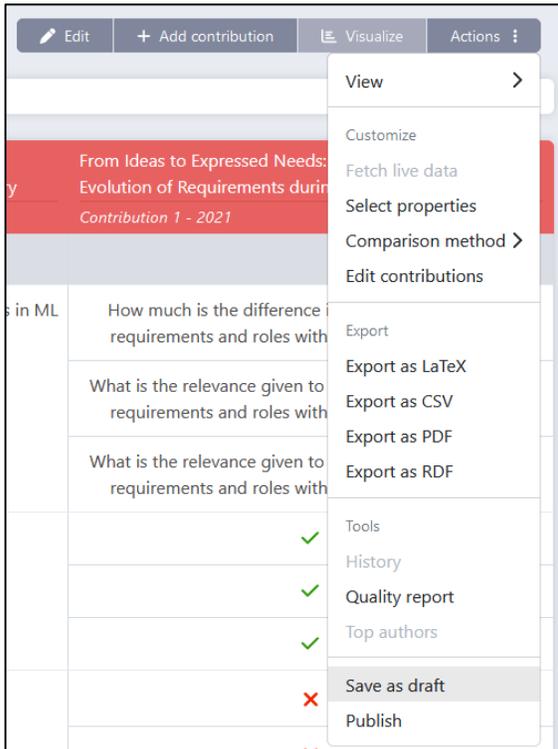
Properties	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry Contribution 1 - 2021	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation Contribution 1 - 2021
research question	Research Question	Research Question
research question/research question		
↳ question*	What is the perception and current treatment of NFRs in ML in industry?	How much is the difference in terms of documented requirements and roles with respect to initial ideas? What is the relevance given to the different categories of requirements and roles with respect to initial Ideas? What is the relevance given to the different categories of requirements and roles with respect to initial Ideas?
↳ highlighted in text*	✓	✓ ✓ ✓
↳ hidden in text*	✗	✗ ✗ ✗
data collection method	Data Collection Method	Data Collection Method
data collection method/data collection method		
↳ method*	interview	experiment
↳ number of participants*	10	30
data analysis method	Data Analysis Method	Data Analysis Method
data analysis method/data analysis method/method*	thematic analysis	descriptive statistics inferential statistics thematic analysis
threats to validity	Threats to Validity	Threats to Validity
threats to validity/threats to validity		
↳ conclusion validity*	✓	✗
↳ construct validity*	✓	✓
↳ external validity*	✓	✓
↳ internal validity*	✓	✓



Comparison | 2 contributions

Properties	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry Contribution 1 - 2021	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation Contribution 1 - 2021
research question/research question		
↳ question*	What is the perception and current treatment of NFRs in ML in industry?	How much is the difference in terms of documented requirements and roles with respect to initial ideas? What is the relevance given to the different categories of requirements and roles with respect to initial Ideas? What is the relevance given to the different categories of requirements and roles with respect to initial Ideas?
↳ highlighted in text*	✓	✓ ✓ ✓
↳ hidden in text*	✗	✗ ✗ ✗
data collection method/data collection method		
↳ number of participants*	10	30
↳ method*	interview	experiment
data analysis method/data analysis method/method*	thematic analysis	descriptive statistics inferential statistics thematic analysis
threats to validity/threats to validity		
↳ conclusion validity*	✓	✗
↳ construct validity*	✓	✓
↳ external validity*	✓	✓
↳ internal validity*	✓	✓

9. Improve ORKG Comparison: Save as Draft



1. Click on “Actions”
2. Click on “Save as draft”
3. Enter a title and click on “Save”
4. The draft is saved in your account

10. Publish ORKG Comparison

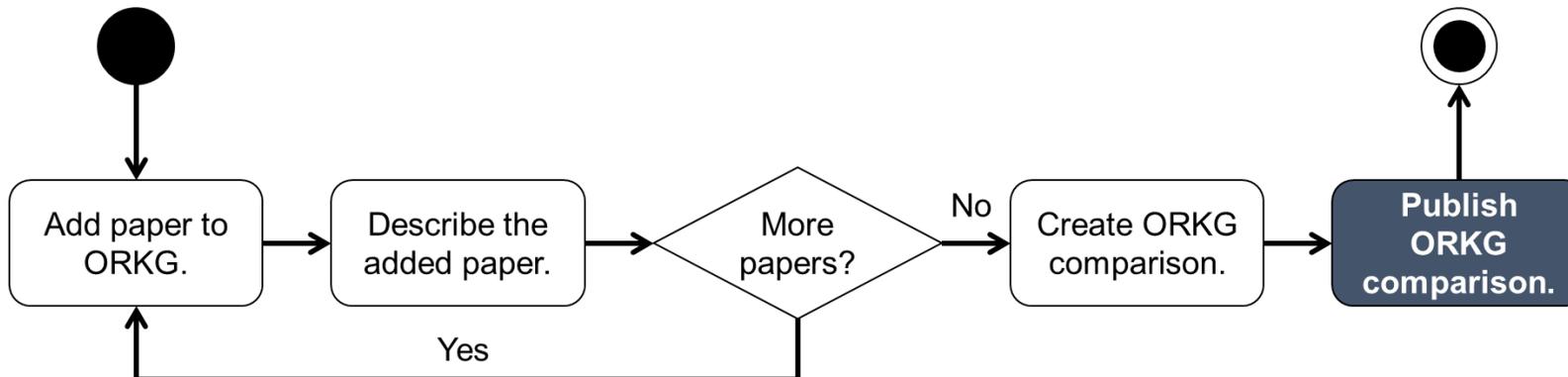
Comparison | 2 contributions

Properties	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry <i>Contribution 1 - 2021</i>	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation <i>Contribution 1 - 2021</i>
research question/research question		
↳ highlighted in text*	✓	✓
↳ question*	What is the perception and current treatment of NFRs in ML in industry?	How much is the difference in terms of documented requirements and roles with respect to initial ideas? What is the relevance given to the different categories of requirements and roles with respect to initial Ideas? What is the relevance given to the different categories of requirements and roles with respect to initial Ideas?
↳ hidden in text*	✗	✗

Edit + Add contribution Visualize Actions

View >

- Customize
- Fetch live data
- Select properties
- Comparison method >
- Edit contributions
- Export
- Export as LaTeX
- Export as CSV
- Export as PDF
- Export as RDF
- Tools
- History
- Quality report
- Top authors
- Save as draft
- Publish



1. Click on “Actions”
2. Click on “Publish”

10. Publish ORKG Comparison

Publish comparison

A published comparison is made public to other users. The state of the comparison is saved and a persistent link is created.

Title ?

Description ?

Research field ?

Creators ?

Assign a DOI to the comparison ?

Reference (optional) ?

Sustainable development goals (optional) ?

Conference (optional) ?

Publish

1. Fill out the dialog
2. Click on “Publish”

Remark:

You can add

- A **DOI** for citation (can also be done later)
- Additional **References**
- Related **Sustainable development goals**
- ORKG partner **Conferences**, such as **REFSQ'25**, that award the **Best ORKG Comparison Award**

Publish comparison

A published comparison is made public to other users. The state of the comparison is saved and a persistent link is created.

Title ?

Description ?

Research field ?

Creators ?

Assign a DOI to the comparison ?

Reference (optional) ?

Sustainable development goals (optional) ?

Conference (optional) ?

a conference
asdadfa
31st International Working Conference on Requirement Engineering: Foundation for Software Quality (REFSQ'25)

10. Publish ORKG Comparison: Result

Comparison | 2 contributions

An Overview of Empirical Research in Requirements Engineering ☆

May 2024 Oliver Karras

This comparison shows an overview of empirical research reported in publication of the IEEE International Requirements Engineering Conference 2021 regarding the topics research question, data collection, data analysis, and threats to validity.

Properties	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry Contribution 1 - 2021	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation Contribution 1 - 2021
research question/research question		
highlighted in text*	✓	✓
question*	What is the perception and current treatment of NFRs in ML in industry?	How much is the difference in terms of documented requirements and roles with respect to initial ideas? What is the relevance given to the different categories of requirements and roles with respect to initial ideas? What is the relevance given to the different categories of requirements and roles with respect to initial ideas?
hidden in text*	✗	✗
data collection method/data collection method		
method*	interview	experiment
number of participants*	10	30
data analysis method/data analysis method/method*	thematic analysis	descriptive statistics inferential statistics thematic analysis
threats to validity/threats to validity		
conclusion validity*	✓	✗
construct validity*	✓	✓
external validity*	✓	✓
internal validity*	✓	✓

Added by
Oliver Karras

Assign to observatory

Now, we **published our ORKG comparison**, a stable version that can be maintained, extended, updated, and published as new versions.

Options after publishing the ORKG comparison:

1. Add visualizations
2. Add DOI later and export citation
3. Use the quality report to get feedback from other researchers
4. Fetch live data for a new draft or published version
5. Fetch data for later analysis with different interfaces

Remark:

These options are only demonstrated live in the tutorial. If you need help, do not hesitate to contact the ORKG team, especially **Oliver Karras** (oliver.karras@tib.eu).